NOVEMBER 6, 1937

ELECTRICAL WORLD

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The Annual

Industrial Power Feature

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Coming Features

Compressed Air Saves at Forging Hammers

Power salesman J. W. O'Nan of Duquesne Light Company tells how the Vulcan Crucible Steel Company eliminated boiler plant, secured diversity of demand and lowered operating costs by substituting compressed air for steam at forging hammers.

Air Conditioning Loads That Improve Load Factor

Anson D. Morston, Kansas Power & Light Company, describes his ten years experience with refrigeration storage, which points to a wider field for more compensatory loads.

Venting Inclosed Buses

An article soon to appear will tell how improved ventilation of inclosed buses has been found to reduce temperatures and increase capacity without overheating disconnect switch contacts and oil breaker terminals.

On the Cover

Eight arc-melting furnaces guaranteed laboratory accuracy for Allegheny Metal production at Allegheny Steel Company's Brackenridge plants. The one on the cover is a 25-ton, 7,500-kva. unit which is served by the West Penn Power Company.

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ELECTRICAL WORLD

NOVEMBER 6, 1937

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The Future of Private Ownership

What is the future for privately owned and operated electric utilities in this country? So much is this question in the minds of utility men that at the recent Indiana Electric Association convention, which drew a large attendance from surrounding states, four of the speakers were asked to discuss this question from different angles.

Any approach to this subject should be from the long-time aspect rather than the immediate future, because public sentiment is too easily swayed by affairs of the moment. Right now, for instance, there is an increasing public reaction against public ownership and wasteful spending by the government on unwarranted hydro projects. A few years ago there was a strong public sentiment against the "power interests." That the pendulum has swung away from public ownership need not be taken, however, as any assurance that private ownership will enjoy any modification of federal or state regulation.

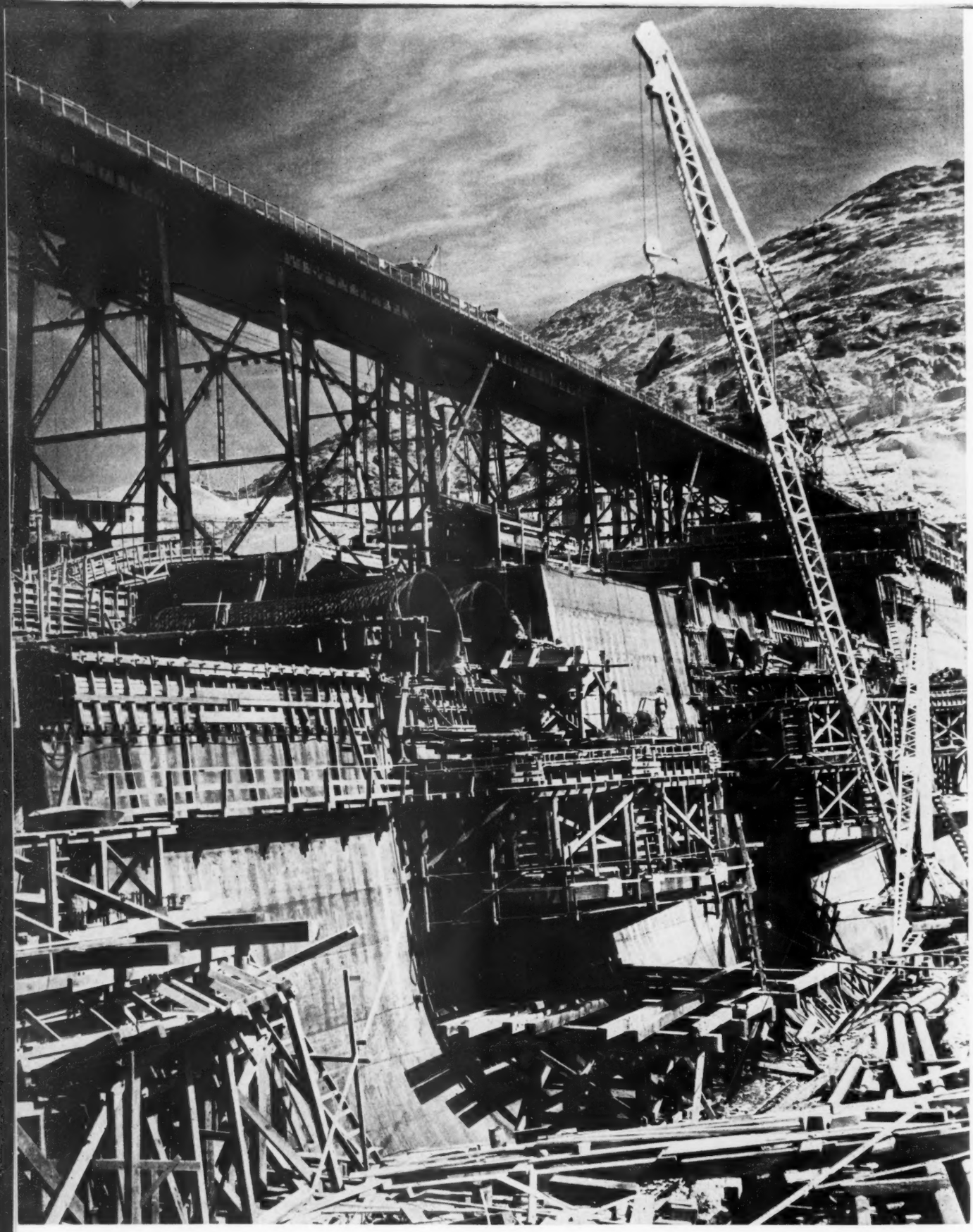
In fact, the very essence of government such as is exercised in this country might well be the only true answer to the question of ultimate ownership. It is obvious that the whole theory of democratic government has changed radically as the result of the depression. New social obligations have been undertaken by government. and to meet the cost thereof taxes must be levied. Since government pays no tax on its own operations and holdings, individuals and privately owned business must foot the bill. Electric utilities, for instance, now pay nearly three hundred millions in taxes, and present the possibility of paying more as the industry expands and spending by political bodies makes greater demands. Therefore, so long as we have a democracy, private ownership is a necessity.

But that does not mean that private business can do as it pleases, provided it pays the taxes. In fact, a democracy in which the elected administration is pledged to a readjustment of social conditions must not only raise large sums of money to meet these requirements, but it must try to bring about conditions that will improve the economic position of the individual. This, obviously, can mean only one thing—more and more restrictive regulation of business.

And therein lies the problem of private ownership. In other words, it will not be a question of whether private ownership shall prevail, but, rather, how to continue to earn a return for investment and at the same time pay higher taxes and operate under increasing restraints.

While it may not be easy, private utilities will find the way. For the electric utility industry it is going to mean better and better management of labor and capital. It is going to mean a more intensive search for net through thoughtful load building, co-ordinated with system planning. It is going to mean more analysis of investment requirement for equipment for service reliability. It will be a challenge to designing engineers to develop new products and new methods that will require less investment without any sacrifice in performance.

The investor in public utility securities may have to be content with a smaller return on his money, but so will investors in other businesses. As for the security of his principal, he must rely upon the ability of his management; for the continued success of the industry will depend upon its own initiative, its courage to look facts squarely in the eye and its willingness to take whatever action is necessary to strengthen its position. Thus while the future is going to bring new and difficult problems, they can be tackled with more inspiration in the knowledge that, under the economy of a democratic form of government, private ownership cannot be destroyed.



WORK PROGRESSES AT GRAND COULEE

The entire flow of the Columbia River will be able to pass through the sixty outlet tunnels in the Grand Coulee Dam. Four of the tunnels, which are each 8½ ft. in diameter, are shown in place and about to be buried in concrete. Each tunnel will be provided with two huge valves. The finished dam will be 300 ft. higher than the trestle shown in the picture

Time Control Refines Water-Heating Load

Controlled Low-Wattage Units Attain Maximum Efficiency, Mimimum Tank Size and Minimum Electrical Demand on the System

By EUGENE VINET *
Edison General Electric Appliance Company, Chicago

WHEN all considerations are taken into account, that form of control of water heating which most advantageously restricts the system and localized peaks is the one which affords the best balance of profitable and economical creation of water-heating load. Also, since load factor is the prime index of demand ratio it is evident that water heating may be approached either as a base load or a valley-filling load. Any one can take his choice to meet local factors, but examination of a recent analysis (Technical Bulletin No. 16) by C. P. Randolph, vice-president Edison General Electric Appliance Company, points toward a judicious valley-filling program as affording better balanced results than a base-load or 24-hour approach to the problem.

Laboratory and field tests correlated with accepted diversity factors and with recorded utility experience are the basis for the conclusion drawn—namely, that the analysis converges toward pre-eminence of the eighteen-hour low-wattage twin unit, or, otherwise stated, that cut-off during relatively short periods gives the best over-all results. This accords appropriate weight to tank cost and sufficiency of hot water service to the customer as well as to cost to the utility to render the service, with its resulting demands on distribution.

In the past possibly too much emphasis in the consideration of water heating has been given to the objective of working otherwise idle generation during night valley hours only and too little to the tax on distribution from loadings that do not keep sharp peaks within proper bounds as dictated by voltage drop. As long as peaks are not increased during the day, any load that is added is good load if it gives existing distribution capacity an opportunity to enhance revenues without incurring distribution investment specifically to handle that particular load. That leads logically to the choice of water heater control and tank capacity which gives satisfactory service with minimum size of unit because it relies substantially less on night-heated storage.

Every local system should be studied before decision is made between ten- and eighteen-hour methods of controlled water heating.

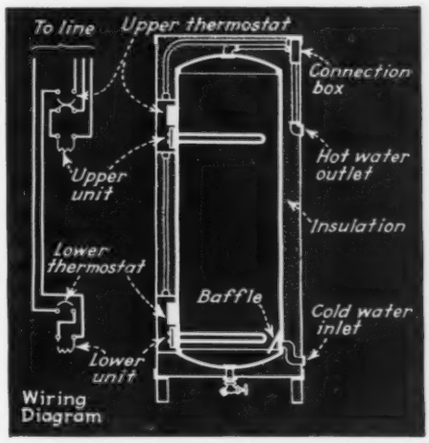
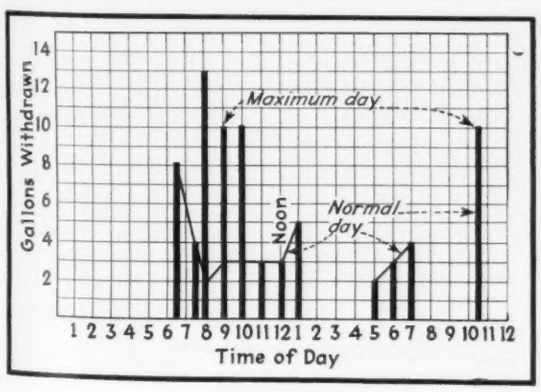


Fig. 2—Only the lower unit is time-controlled

Upper unit one-quarter the way down from the top of the tank. Each unit is thermostatically controlled and the two units are interlocked against simultaneous operation so as to limit demands. Units are 20 watts per gallon of tank capacity for the lower unit and 30 watts for the upper unit.



	Gallons per Day	Days per Month	Gallons per Month
Maximum day	75	5.0	375
Normal day	50	13.4	670
Minimum day	20	12.0	240
Total		30.4	1,285

Fig. 1—Typical daily draw-off totals to 1,285 gal. per month

This schedule is the foundation for the discussion presented in the article. It was presented in the 1931 report of the N.E.L.A. water heating committee. It is representative of most homes of four or five people and is based on an average temperature of 150 deg. F. When extended to cover the month the gallons required are about as indicated in the table. On the basis of 92.5 per cent efficiency this represents a monthly consumption of 340 kw.-hr. Note that 60% of the water is withdrawn during forenoon hours of a typical day.

* Paper presented at Edison Electric Institute engineering committee meetings, Cleveland, Ohio, October 12, 1937.

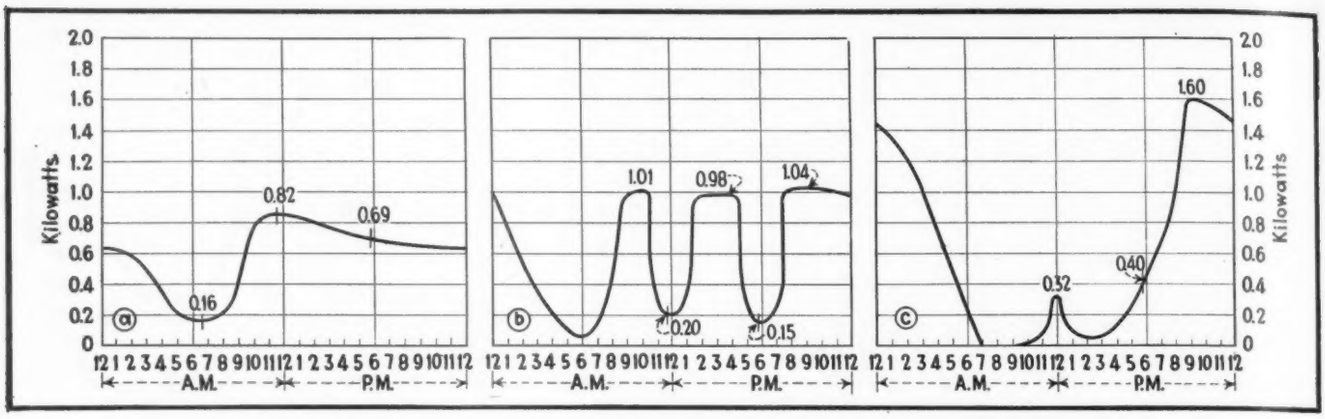


Fig. 3—Eighteen-hour charge shows high diversity of upper unit on maximum-use day

Diversified low-wattage water heater load per customer at the distribution transformer. On the basis of four to six water heaters per line transformer with average monthly consumption of 340 kw.-hr. per water heater. Maximum day, 13.98 kw.-hr. in each case, 4,080 kw.-hr. per year.

(a) Uncontrolled 24-hour heater. Twin units in 40-gal. tank, lower unit 0.6 kw., upper unit 1.25 kw.

(b) Controlled eighteen-hour heater. Twin units in 40-gal. tank. Lower unit 0.75 kw., upper 1.25 kw.

(c) Controlled ten-hour heater. Twin units in 66-gal. tank. Lower unit 1.25 kw., upper 2.00 kw.

These loads are later to be added to the other loads of full-use customers in Fig. 4. If six of the upper units should all be functioning simultaneously the load would be at least 7½ kw. for any of the three types of heaters. Actually, the diversity resulting from the thermostatic floating of the upper unit in conjunction with time control of the lower unit holds the diversified load at the times of maximum range use (noon and evening) to a maximum equivalent 0.2 kw. for each upper unit of each heater in the case of the eighteen-hour heater. That means 1.2 kw. demand for all six heaters and, in turn, that signifies a diversity factor of about 6¼. This may seem large, but experience with ranges has established comparable diversity factors which were no less startling when they were first suggested.

No single answer as to manner of molding water-heating load is going to be applicable indiscriminately to all utilities because of variations in proportions of domestic, commercial and industrial loading and to other factors that will modify the over-all loading of transformers and substations. Relative saturations are changing as the standards of living improve and as companies find it feasible to promote particular kinds of utilization of energy. Nevertheless it is possible to take typical system loadings and typical objectives of further loading

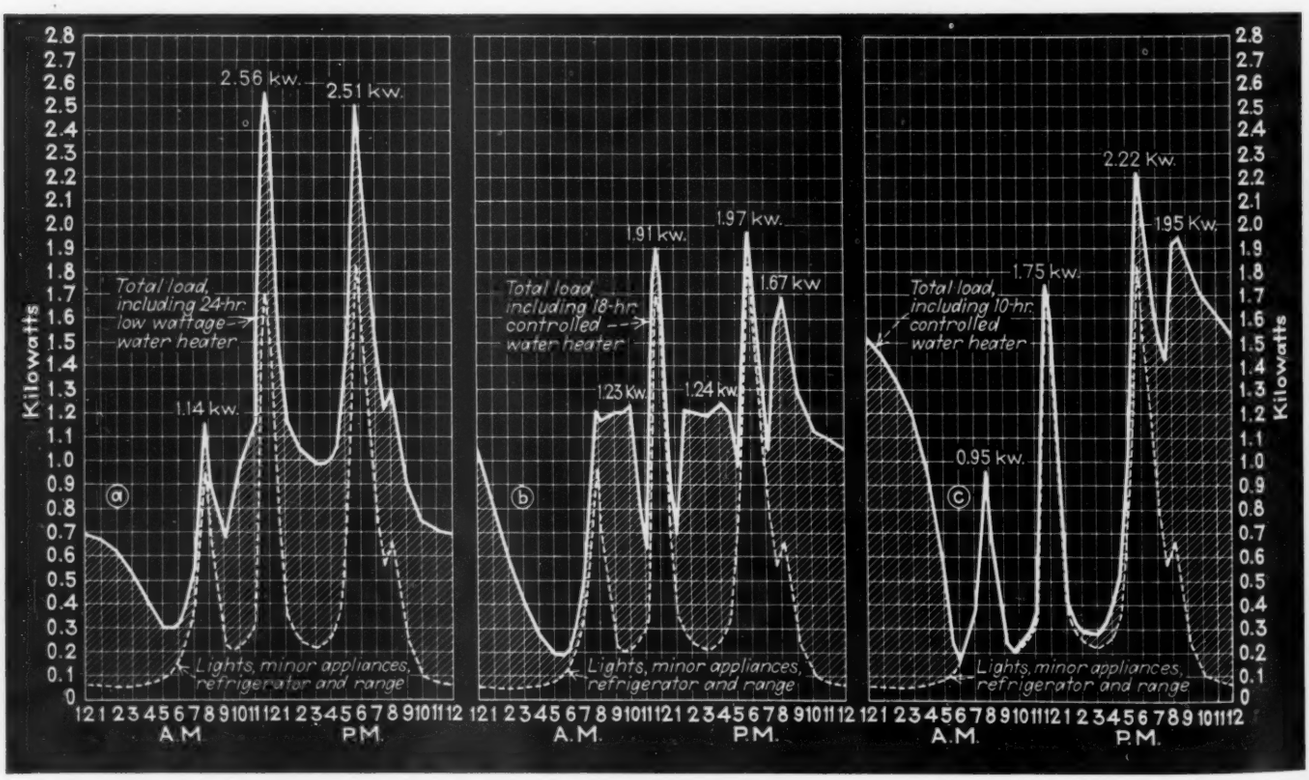


Fig. 4—Full-use customers give best economics at the transformer when water heaters are on eighteen-hour control

Shaded areas are the water heater loads transferred from Fig. 3 in each case. Consumption 550 kw.-hr. per month per customer. Diversified demands on fifteen-minute basis; 25 customers per line transformer with ten to fifteen refrigerators, seven to ten ranges and four to six water heaters among the 25 customers.

(a) Twenty-four-hour uncontrolled heater.

(b) Eighteen-hour heater with lower unit time-controlled.

(c) Ten-hour heater with lower unit time-controlled.

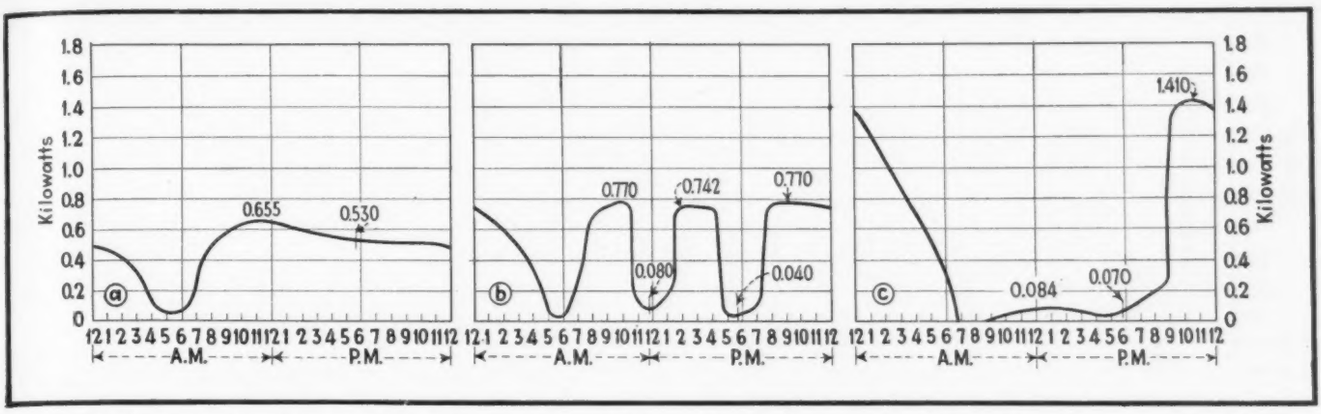


Fig. 5—Substation diversities at critical hours are most favorable in the case of the eighteen-hour controlled heater

Charts represent conditions resulting from 500 heaters operating under same data as presented in Fig. 3.
(a) Twenty-four-hour uncontrolled heater.
(b) Eighteen-hour heater with lower unit time-controlled.
(c) Ten-hour heater with lower unit time-controlled.
These charts lay the foundation for the advantageous valley-filling portrayed by Fig. 6 when the customers are increased to embrace 2,000 to 3,000.

in the process of finding the most advantageous approach to the largest single domestic load now in sight—namely, the domestic water heater.

Standardization a worthy objective

A further consideration is the desirability of promoting this load under such conditions as to encourage the highest practicable degree of standardization of equipment and the smallest practicable number of sizes of tanks to meet the domestic hot-water requirements. This is necessary if manufacturers' prices are to be induced toward levels that will make the appeal of water heating greatest to those who have to buy the heater if there is to be any response to sales efforts.

No discussion of water heating can lead to generally acceptable conclusions unless it is based on a generally accepted program of hot water withdrawals as fixed by the habits of the typical user, along with an appropriate range of temperature maintained throughout the service. Lacking any program thus far officially adopted, this analysis has been based on the data of the former N.E.L.A. water heating committee as shown in Fig. 1.

Rather than complicate the text at this point by injection of the other detailed quantities on which this analysis has been founded, those data have been incorporated into the accompany-

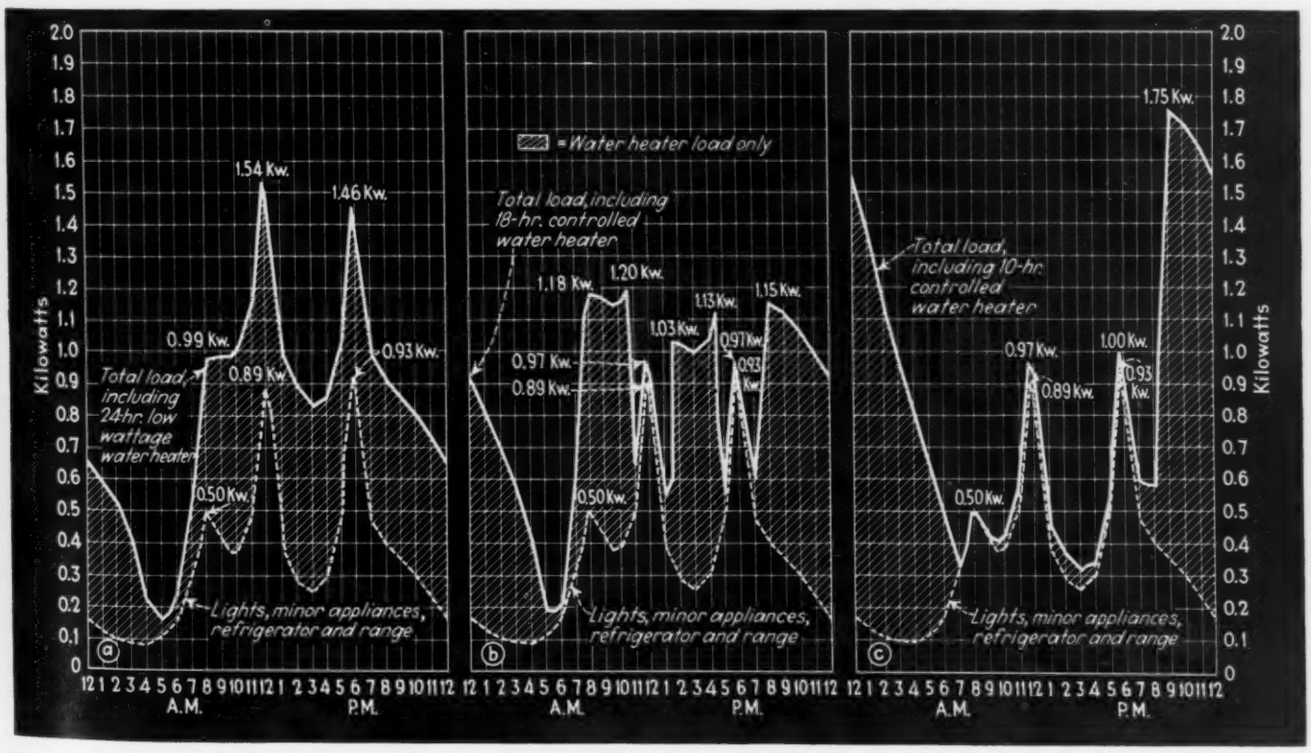


Fig. 6—At the substation the eighteen-hour controlled heater gives minimum demand for 2,000 to 3,000 full use customers

Refrigerators and ranges assumed for 1,500 customers and water heaters for 500.
(a) Twenty-four-hour uncontrolled low-wattage unit heaters.
(b) Eighteen-hour heater with lower units time-controlled.
(c) Ten-hour heater with lower unit time-controlled.
Shaded areas are water heater loads transferred from Fig. 5.

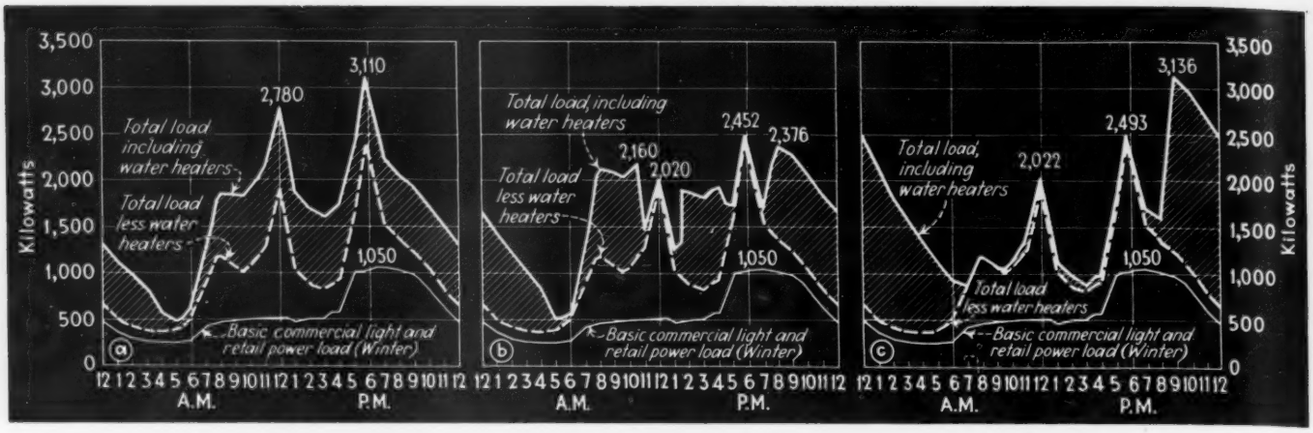


Fig. 7—Ten-hour (or night-storage) heater incurs risk of creating new substation peak during late evening lighting hours as saturation exceeds 25 per cent

Again the eighteen-hour time-controlled heater shows to best advantage when considered in conjunction with characteristic commercial light and retail power loads at the substation on the annual peak day. Substation assumed to serve 3,000 domestic customers with full saturation of lights and minor appliances, 60 per cent saturation of refrigerators and ranges and 45 per cent saturation of water heaters. Peaks are held to values more than 20 per cent lower in the case of the eighteen-hour controlled heater than in the case of the 24-hour uncontrolled or the ten-hour controlled (storage) heater.

ing illustrations. They tell better than words why the eighteen-hour time-controlled heater best answers the problem of giving the customer his hot water as he wants it and at lowest outlay to him, and at the same time necessitates the least outlay on the part of the utility to carry the added load.

The illustrations are arranged in logical order of evolution from the withdrawal schedule assumed for the typical user, through the diversities of representative numbers of water-heating customers to the diversified loading of individual transformers and of a typical substation serving a small community.

Time control builds balanced load

It is believed that a study of these load curves leads surely to the conclusion that, for the general case, time-control for the lower unit in a two-unit heater of such size as to involve eighteen hours of operation affords a better balanced load-building result than either a 24-hour heater or one functioning essentially as a night-storage device. Expressed otherwise, the controlled low-wattage-unit heaters attain maximum efficiency, minimum tank size and minimum electrical demands on the system. Meanwhile, the practice of floating the upper unit under thermostatic control only is an accompanying assurance of adequate hot-water service, as the average customer uses it on either a minimum day, a normal day or a maximum day.

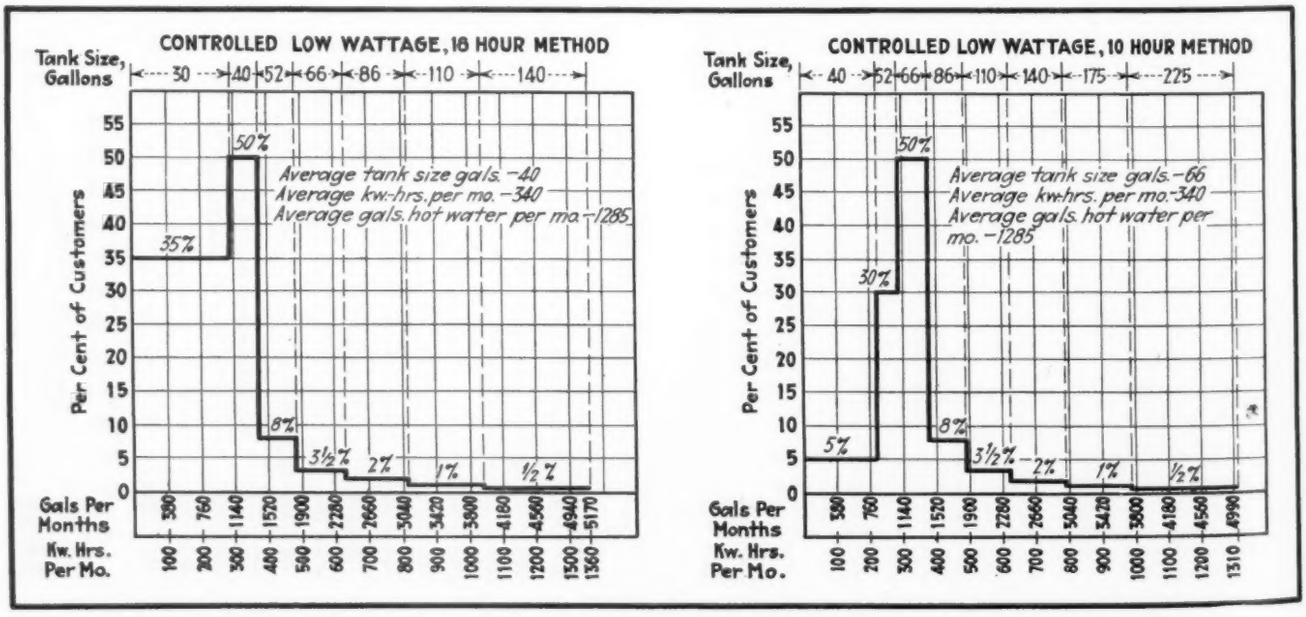


Fig. 8—Time-controlled units on eighteen-hour operation facilitate sales by permitting concentration on lower cost heaters

The ten-hour, night storage, controlled heater necessitates that half the customers have 66-gal. tanks, whereas with the eighteen-hour schedule half of the customers are adequately served by 40-gal. tanks. Twin-unit type heaters, lower unit 20 watts per gallon, upper units 30 watts per gallon.

Small pilot wire installed (bottom position) with secondary and relay mounted on pole

Multiple Street Lights on Polarized Relay Control

One Low-Voltage Pilot Wire Controls Both All-Night and Midnight Lights in Replacement of Series System

By T. F. HILDEBRAND
American Gas & Electric Company, New York

IN THE revamping of the downtown distribution system of Roanoke, Va.,* among the objectives desired were the simplification of circuits, the improvement of appearance of pole leads and the elimination of the hazards of open-wire, high-voltage circuits. With the primary lines to be installed in insulated aerial cable and special arrangements made for installing transformers, only the series street-lighting conductors serving an ornamental type of street-lighting system remained exposed. Not only was the series system served from comparatively large station-type, constant-current transformers which had open-circuit voltages of around 10,000 volts and normal operating voltages of more than 5,000 volts, but the open-wire series conductors required crossarms on the poles, both of these being objectionable. It was desired to eliminate the old, high-voltage series transformers and circuits and to eliminate the need of crossarms in the area to be rebuilt.

After considering several schemes of revamping and controlling the street-lighting system it was decided to change from series to multiple in the area involved and to control the multiple street lights by means of a polarized relay and control scheme recently put on the market under the trade name of "Polatrol." Simply stated, the new system consists of a source of d.c. energy, either battery or rectifier, with switching arrangements for impressing a positive or negative impulse on a one-wire pilot circuit extending to the polarized relays mounted on the poles and which either connect or disconnect the street lights from the 120/208-"Y"-volt secondary system, depending upon the polarity of the impulse.

Several advantages realized

The "Polatrol" system offered several advantages which led to its selection for use in Roanoke. One of the main advantages was that both midnight and all-night burning lights could be positively controlled by a single-wire pilot circuit. The control equipment involved and the relays were relatively simple and easily operated. The relays were small, permitting mounting in the base of steel poles, or being unobtrusive when mounted on the side of a pole. The pilot wire need be energized only for a few seconds a day, then at not more than 120 volts, thus eliminating the need of any high-voltage street-lighting conductors and permitting

* An article in the August 28, 1937, issue of ELECTRICAL WORLD described the features of the Roanoke distribution system in detail.

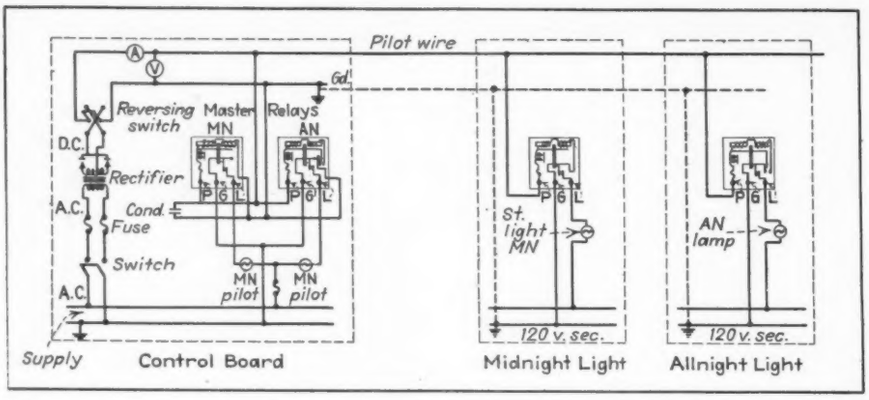
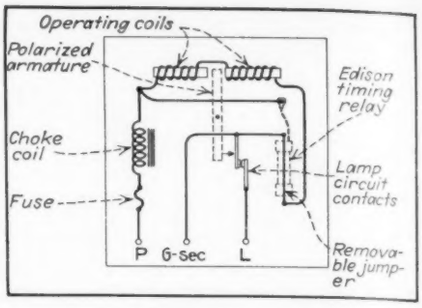


Fig. 1—Polatrol control board, pilot circuit and relays for Roanoke's multiple street-lighting system



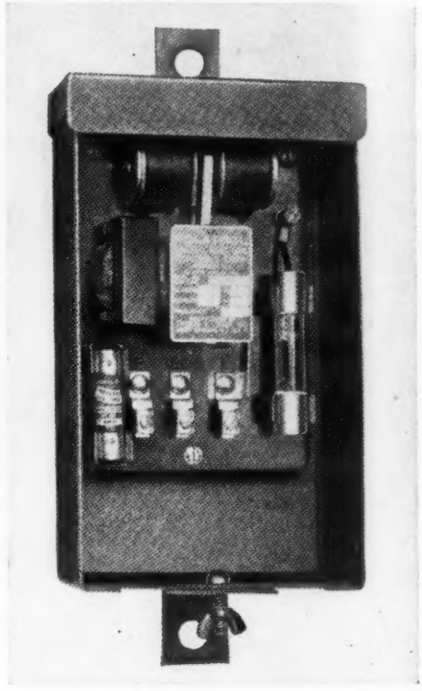


Fig. 2—Polarity of impulses effects selection

Above—Diagram of relay circuit. Below—Inside view of polatrol relay.

the pilot to be installed in the same manner and along with the regular secondary conductors. Cost of establishing the "Polatrol" system was as low as or lower than other schemes considered and the total investment for the new multiple system was lower than the investment in the old series circuits and equipment.

A simplified diagram of Roanoke's multiple system control set-up is shown in the simplified diagram of Fig. 1. A diagram of the Polatrol relays used for the midnight and all-night burning lamps appears in Fig. 2. A factory-built control panelboard (Fig. 3) was obtained and set up in an attended station. This board was completely wired and self-contained, including a 120-volt tube-type rectifier, reversing switch in the d.c. circuit, together with necessary switches, protective fuses, etc. In order to give the operator an indication that proper current and voltage conditions prevail and that the proper operating sequence is followed an ammeter and voltmeter were placed in the d.c. pilot circuit and master "Polatrol" relays with indicating pilot lights were installed on the board.

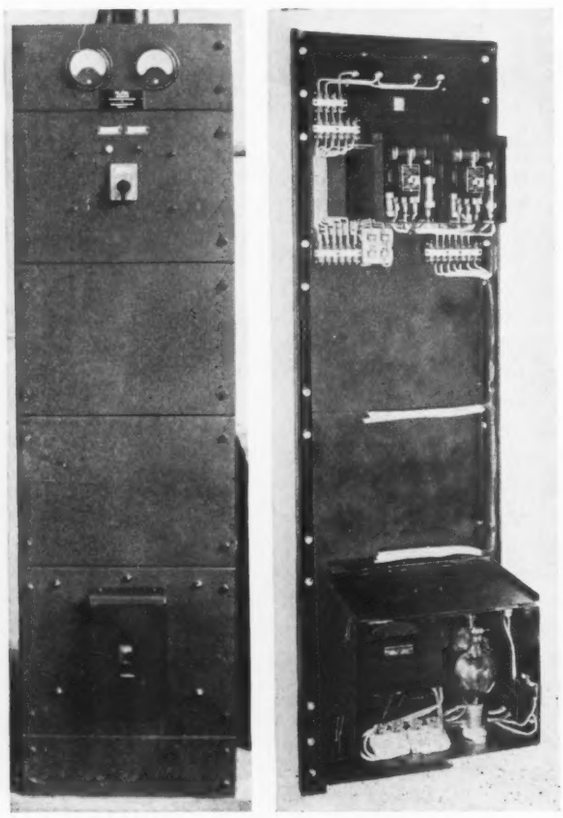


Fig. 3—Simple board controls lighting circuits

Left—Front view of control board. Blank panels for future developments. Right—Rear view with equipment covers removed.

One side of the d.c. circuit is permanently grounded at the station, the other extending out of the station to the street light control relays as a one-wire pilot, where the circuit is completed through the relays to the secondary system grounds. In order to eliminate all unnecessary wire crossings at street intersections the headguys between adjacent secondary sections were used as the pilot wire in many places. The guys were insulated from the poles and ground by the usual guy insulators, and the pilot wire, normally carried along with the secondary conductors on a five-spool rack, connected into the head-guy at end of secondary runs.

Two functional relays identical

The relays controlling the midnight and all-night burning lamps are identical excepting for an auxiliary Edison thermal timing relay or "selector" inserted in the control circuit of the all-night light relays. Fig. 2 clearly shows the relay circuit. With a negative impulse on the pilot "P" the top of the polarized armature swings to the left operating coil, closing the lamp circuit from "G" to "L." With a positive impulse on the pilot, the armature swings to the right operating coil, opening the lamp circuit contacts. The action of the relays is practically instantaneous, requiring an impulse of only a second or two, thus when a two- or three-second negative impulse is placed on the pilot wire all

[*Continued on page 152*]

Getting a Start on the Attic Ventilation Load

By R. M. WINSBOROUGH
Southwestern Gas & Electric Company, Shreveport, La.

Attic ventilation is, of course, not air conditioning, yet it has load-building potentialities, and, in addition, offers something of a talking point for later conversion to complete air conditioning. Its load-building possibilities, operation costs and estimated annual revenue obtained are presented in this analysis of the activities of a Southern utility.

IN APRIL, 1936, our company decided to see what could be done with the promotion of attic ventilation in Shreveport, La., where we have 18,000 domestic electric customers.

We concluded to promote attic ventilation through the dealers. If we were to get a satisfactory job done it meant we had to persuade the dealers that the equipment for attic ventilation was a product which they could merchandise at a profit and that the business was susceptible of volume development at prices which provided satisfactory profit margins.

The average installed prices in Shreveport of 36-in. fans for which we obtained outlets were Ventura, $200; Bar-Brook, $109.50; Buffalo-Forge, $109.50; Robbins & Meyers, $200; Ilg, $175; Diehl, $175.

Three types of advertising used

We presented to the dealers a plan which consisted of three types of advertising. The first was a series of ten 54-in. newspaper advertisements presenting for the first time in Shreveport the idea of home cooling by attic ventilation. Each ad contained the names of all dealers, also the name of our company, and offered a free booklet describing attic ventilation, called "Comfort Cooling."

The first newspaper ad was published on June 10 and the last one on July 26. The start was too late. We would have done much better if we had been ready to begin our advertising about May 1. This year we started advertising in April to reach a peak about May 15 and to continue through May and June.

The second part of the promotion we offered to the dealers was the use of the booklet "Comfort Cooling." Each dealer who handled any line of attic fans was supplied with as many books as he could use to advantage. We went through our meter books and made a list of all the customers who were using more than 100 kw.-hr. per month. There were about 1,100 of them, and to this entire list we mailed the booklet with a letter and a return postcard.

Our returns were very disappointing. Just what the reason may have been we have not been able to determine. I think, personally, there were three weaknesses in the mailing. In the first place the booklet was not nearly so effective as it might be. It did a very poor job of selling attic ventilation because it did not explain clearly what the process was and did not give even an inkling as to its probable cost. The second weakness in the mailing was the letter. The letter did not do a good job of selling the book nor of selling the idea of attic ventilation. Worse than that, it gave the customer notice that if he filled out and returned the postcard he would certainly be called on by a salesman to discuss the matter of installation I think the failure to do a selling job in the letter, combined with the fact that the customer was put on notice that a salesman would call, tended to keep down the number of returns. The third weakness was that the postcard, instead of being attached to the letter, was clipped to the inside back page of the book. The postcard should have been loose, so that it would be detached from the book at the time the clip was removed which released the letter. But in spite of these weaknesses we did receive some inquiries in the mail, and these were passed around to the dealers in rotation.

Radio advertising effective

The third type of advertising which we did for the dealers was by radio. We had been using a ten-minute news broadcast on two local radio stations. Both of these were daytime broadcasts, one of them coming at 10:30 in the morning and the other at 5:50 in the afternoon. The program consisted of an opening announcement, four minutes of news, a commercial "plug" in the middle, four minutes of news, and a commercial "plug" at end. During the months of June and July we devoted at least one of the announcements on each program to attic ventilation. The free booklet was offered to anyone who would call on a dealer, or at our company, or who would write to the station for it. The radio advertising produced excellent results.

While this advertising was going on a great deal of work was done with the dealers to get their salesmen fairly acquainted with the attic ventilation idea and to be sure that the dealers had sufficient salesmen to take advantage of the interest we were creating by the advertising. We wound up with eight dealers well equipped for the work and with a total of ten full-time salesmen who spent June, July and a part of August and September on attic ventilation. Beginning with June and ending with December,

[*Continued on page 138*]

Copper Brazing Lowers Bus Jointing Cost

Silver Alloy Brazing Technique Eliminates Bolting in Field Fabrication of Copper Bus, Reduces Joint Resistance, Cuts Material and Labor Cost

By R. A. GOELLER
Vice-President Hatzel & Buehler, New York City

IN a recent operation at the Brooklyn conduit plant of Steel & Tubes, Inc., a subsidiary of the Republic Steel Company, more than 20 tons of copper busbar were installed on what is considered to be one of the largest electrogalvanizing plants in the country.

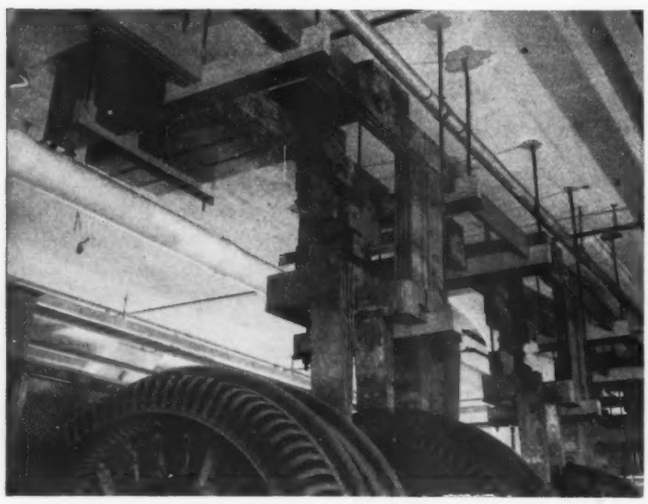
A factor in this undertaking was the installation of an electrical busbar system capable of delivering some 36,000 amp. at 4 to 5 volts, in which the type of busbar joint limited the impairment and reduced the maintenance to the lowest possible minimum under severe operating conditions.

With these heavy currents jointing of the busbars was an all-important problem, and to avoid deterioration and resultant voltage drop a combination soldered and bolted installation, using drilled holes, was specified. Due to the estimated cost of soldering the joints, some of which consisted of eight 6x½-in. bars, the figures submitted on this basis ran considerably in excess of what had been anticipated.

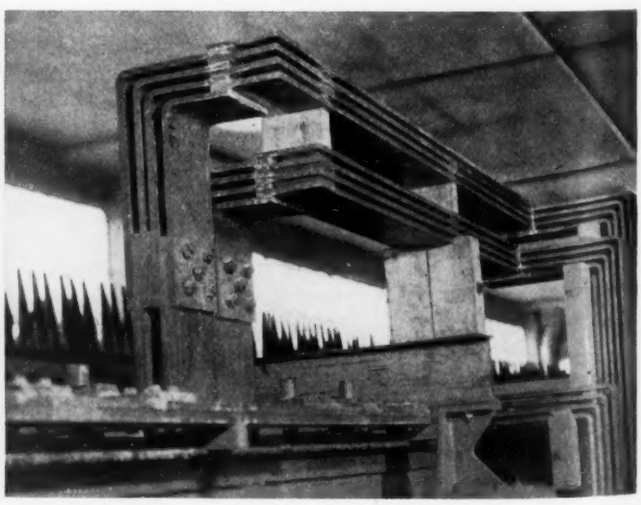
Alternate estimates were prepared based upon eliminating the soldering and a major part of the drilling and in their place use a 6-in. lap and a five-bolt clamp, the fifth bolt to be centered between the four others and the copper drilled to receive it. Other alternatives were considered, such as silver plating all joints before assembly and also the use of silver foil between each joint, but for obvious reasons they were dropped.

While designing the busbar clamps for this installation, having in mind the several problems, the idea occurred, why not make a departure in technique? It was natural that electric welding should come to mind first, and pursuing the thought further it was found that portable equipment of several types was available, but unfortunately not in the required capacity for this job. The cost of special equipment and the time for manufacturing it made it necessary to abandon that idea—regretfully. Consultation with the Air Reduction Company, however, brought out the fact that a perfect mechanical job could be made in the field by brazing the busbars with low-temperature alloys. Several brazing alloys were available and their cost, the type of torch and capacity of gas tanks, methods of clamping during the braze and the skill required to make the braze and the labor time expended were studied.

In determining the amount of lap



Silver alloy brazing displaces soldering and bolting for bus system carrying 36,000 amp.



Brazed buses terminate in bolted joint at the galvanizing tanks to permit easy disconnection

for the joint it was decided that three times the thickness of copper was sufficient as far as mechanical strength was concerned. Thus for 6x½-in. busbars, which was the size representing the greatest bulk, this meant a 1½x6-in. lap or 9 sq.in. of lap surfaces. How well this was justified, both mechanically and electrically, the following extract from reports on tests will show.

Test pieces of copper were arranged for and several joints made in the laboratory of the Air Reduction Company, with members of our staff present. Set forth in Table I is their report on cost of brazing alloys, gas and actual time expended in making the joints.

In comparing the material cost of a joint in ½x6-in. copper against ¼x4-in. copper it will be seen that as the mass is increased twice the gas costs rose approximately eight times, while the labor time is practically proportional. This is accounted for by the increased gas consumption due to the change in the style of tip and change in gas pressures.

In passing, it is interesting to note that during the tests ordinary thumb screws or "C" clamps were used to hold the lap together during the brazing process and that similar clamps were employed in the fabrication of the job proper.

With the jointed samples completed and master test pieces prepared without joints, both electrical and mechanical tests were made and the results as set forth in the report of the Electrical Testing Laboratories are shown in Table II.

Three outstanding facts are obvious from this report. They are:

(a) That the two pieces of 6x½-in. copper with 1½-in. lap joined by low temperature brazing alloys had a lower fall-of-potential by 0.2 m.v. than a sample of similar length without a splice.

(b) The tensile strength of the joint was extremely high, as indicated by the fact that the two 6x½-in. pieces parted at 68,500 lb.

(c) A lap of 1½ in. on the 6x½-in. busbar was ample, both mechanically and electrically.

With the result of these tests before him, F. M. Darner, chief engineer of Steel & Tubes, Inc., rendered a

Table I—Estimated Cost of Sil-Fos Brazing

½x6-In. Copper Bus (Lap 1½ In.)

Sil-Fos per joint 1½x6x0.01 in.—about 0.46 oz. at $3.50 per lb.	$0.099
Oxygen per joint 10 cu.ft. (Style No. 4 to No. 10 tip, 10 lb.) at $1.60 per C cu.ft.	0.16
Acetylene per joint 10 cu.ft. (Style No. 4 to No. 10 tip, 10 lb.) at $3.15 per C cu.ft.	0.315
Material cost per joint	$0.574
Material cost per sq.in. $0.574 ÷ 9	0.064

Total torch time per joint	3 minutes
Time cleaning, fluxing and assembling	5 minutes
Total time	8 minutes

¼x4-In. Copper Bus (Lap ¾ In.)

Sil-Fos per joint ¾x4x0.01 in.—about 0.1 oz. at $3.15 per lb.	$0.033
Oxygen per joint 1.5 cu.ft. (Airco No. 9 tip, 5 lb.) at $1.60 per C cu.ft.	0.024
Acetylene per joint 1.5 cu.ft. at $3.15 per C cu.ft.	0.047
Material cost per joint	$0.104
Material cost per sq.in. $0.104 ÷ 3	0.035

Total torch time, per joint	1½ minutes
Time cleaning, fluxing and assembling	3 minutes
Total time	4½ minutes

Note:—No allowance made above for depreciation, wastage, lost time, etc.

Table II—Results of Tests

Fall-of-Potential Measurements

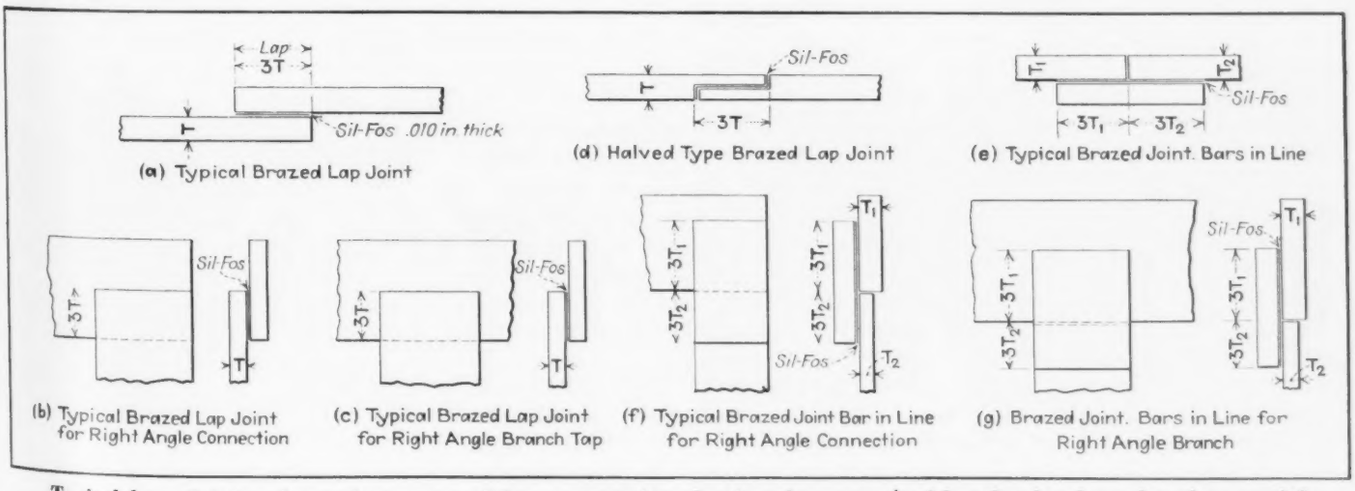
The drop-of-potential at 1,500 amp. (d.c.) was as follows:

Test No.	Size of Bus	Length of Lap, Inch	Approximate Temperature, Deg. C	Drop-of-Potential Between Two Center-Line Points, 12 In. Apart, Mv.
1	½ ft.x6 in.	1¼	34	4.0
2	½ ft.x6 in.	3	33	3.7
3	½ ft.x6 in.	Bus—no joint	34	4.2
4	½ ft.x4 in.	¾	47	13.0
5	¼ ft.x4 in.	¾	50	13.2
6	¼ ft.x4 in.	Bus—no joint	51	13.3
	Room air		23.5	

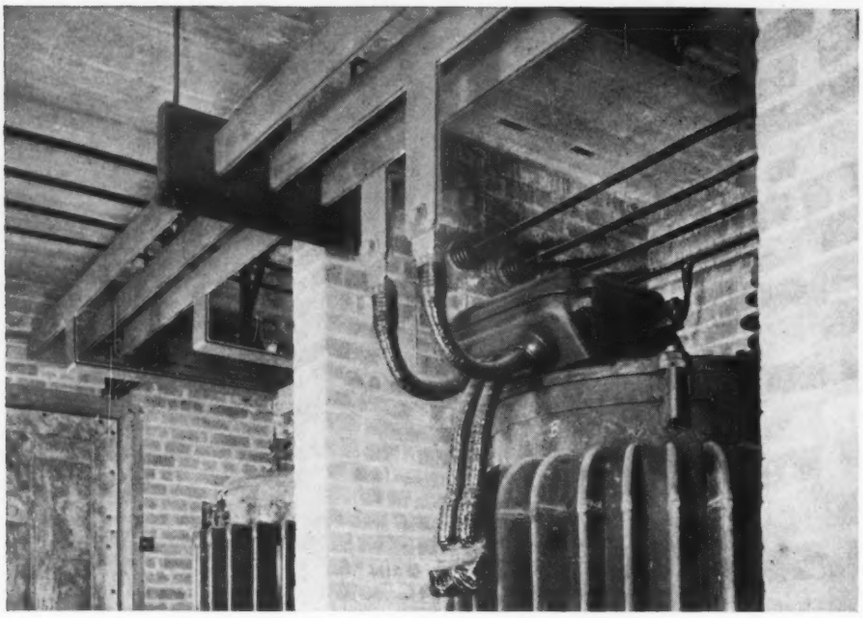
Note:—The current had been maintained at 1,500 amp. for about one hour. The temperatures were not constant and no effort was made to prevent heat flow from one section to another. The temperature was slowly rising during the test period.

Tensile Strength

Tensile tests were made on joints Nos. 1 (½x6x1½-in. lap) and No. 4 (¼x4x¾-in. lap). The breaking loads were 68,500 lb. and 24,900 lb. respectively. There was no definite indication of the yield points.



Typical brazed joints for various types of bus construction showing the amount of lap that has been found successful



Applied to substation bus structure serving this installation brazing makes a neat and effective joint

decision to proceed with the brazing.

It was decided to use Sil-Fos low-temperature brazing alloy, since it could be obtained in sheets of 0.01 in. thickness and had a low melting point of 1,300 deg. F., which meant low gas consumption. Sil-Fos is a low-temperature brazing alloy developed by Handy & Harmon and consists of 80 per cent copper, 15 per cent silver and 5 per cent phosphorus. In the application of the heat to the joint, phosphorus, acting as a fluxing agent, is consumed, leaving an alloy essentially copper and silver, which accounts for the low electrical resistance of the joint.

Joint simple to make

The method of making the joint was simple. With a power-driven sander the contact faces of each bar were prepared in the usual manner. Then a strip of brazing alloy about 1/32 in. shorter than the lap was cut, and after flux was applied to both sides the alloy was placed between the two bars and clamped by means of two "C" clamps, which were set up tight enough to hold the bars in position. The joint is then ready for the torch and heat is applied until the alloy runs out at the edges. An extra turn of the "C" clamp, removal of the heat, slight cooling time and the joint is complete. In special cases brazing alloy was used in rod form, similar to solder, to fill voids that could not be handled otherwise. One important point in making joints in heavy busbars having a multiplicity of laminations should be stressed here; it is the fact that each pair of bars had to be joined separately and not all as a unit.

At the plating tanks the use of brazed joints provided a method that was free from acid corrosion and subsequent deterioration normally present in a clamped or bolted joint. Thus there were no bolts or clamps to corrode or produce reaction of dissimilar metals under acid conditions.

The accompanying diagrams (a, b, c and d) illustrate several joints used by us on this operation and the formula which was applied for the various laps. Another method using splice plates (e) was adopted on a subsequent operation and provided an arrangement where the buses were aligned at the joints rather than offset. In long runs in exposed locations this method is often desirable. Diagrams (f) and (g) show the same principle as (e) applied to a right-angle joint and lap respectively.

It is quite obvious, too, that changes in direction or laps at more or less than 90 deg. can be easily accomplished and a large amount of flexibility be provided in assembly through the ability to slide one bar over the other until properly positioned and then complete the joint.

In making joints of this character, where heat is employed, expansion of the metal is a factor, and therefore care must be taken in fabrication to allow for this and the subsequent contraction. The question has been raised —why not a butt-weld? The answer is, it can be done, but practical field difficulties do not warrant it, for it would be necessary to machine the ends, have special clamps to hold the bars in position and then put them under pressure. Expansion and the small margin of surface to work with indicate the lap method, unless there are special conditions to be met with.

While the advantage of a joint impervious to corrosion, mechanically strong, having no greater resistance (less in fact) than a solid piece of copper, and which will not change during the life of the joint, is of paramount importance, the question naturally arises, "What does this method cost over the old means of bolts or clamps."

The saving in copper poundage at the joints was unusual, and based upon a 6-in. lap on the 6x½-in. bars for the clamping or belting method, as against a 1½-in. lap used for the brazing process and for the smaller sizes in proportion, we have arrived at the following estimates of savings:

	Lb.
8— 7x6-in. Rabbited joints	24
320—½x6-in. Right angle joints	1410
6—½x5-in. Right angle joints	6
40—¼x6-in. Right angle joints	102
96—¼x5-in. Right angle joints	72
192—¼x4-in. Right angle joints	103
Total savings in pounds	1,717
Total savings in dollars ($0.18 base) 1,717x$0.18	$309.06

Analysis indicated that we had an approximate total of 4,233 sq.in. of brazed joint, and against this we had the following material costs:

Acetylene and oxygen	$232.00
Sil-Fos and flux	87.50
Welding torch and accessories 50 per cent depreciation	149.23
Total material cost	$468.73
Cost of material per sq.in. of joint = $0.11	

Joints for a 6x½-in. bus having a 1½-in. lap were the greatest in number. The average cost of material for such joints based on 9 sq.in. per joint was $0.99.

From the above data for a joint in a 6x½-in. bus with a 1½-in. lap the following over-all field costs were calculated:

Field Cost of Brazed Joint

(6x½-in. bus, 1½-in. lap)

Labor, welding and assembly (based on $1.70 per hour plus 20 per cent supervision)	$0.52
Oxygen, Sil-Fos flux	0.99
Miscellaneous expenses	0.03
Copper ($0.18 base) bars — lapping 1½-in.	0.26
Field cost total	$1.80

[*Continued on page 122*]

Industry's Consultant

—the Power Salesman

AS ONE looks over a number of case studies of the contributions that power salesmen have made to the improvement of industrial processes and economy there comes the solid conviction that the relationship between industry and the power utilities is much more than that which ordinarily exists between customer and supplier. Because the recommendations of the power salesman so often involve considerations that fundamentally are much more concerned with industrial engineering than with power, he stands more in the position of consultant than salesman.

INDUSTRIAL management that is willing to look beyond the bookkeeping costs of today finds in the services of the power salesman the possibilities for long-range production economies, efficiencies and improvements that are of much greater significance in product cost, quantity and quality control than is the entire cost of power.

JUST as the manufacturer of shoes, or of steel or any other product is a specialist in his own field, so is the power salesman a specialist—a specialist in light, heat and power. The only product he has to sell is electric service. And for that reason he must necessarily be careful to recommend equipment that he knows will put that service to work to the best advantage of the customer. He knows that unless he can speed up his customer's production, improve quality, reduce waste, lower accidents, improve employee morale or lower costs he cannot expect to sell more power.

BACK of the power salesman is an organization that is interested not in any profit that might come from equipment sales, but only in improving and extending its service to customers. Any industrial problem that involves production control or speed-up, light, heat, humidity and dust control or the more economical and efficient use of electricity in any way is grist to the mill of the power salesman. Whether it involves knowledge he already has, or requires an investigation of similar operations elsewhere, a plant survey, laboratory research or what, he and his company will, within reason, do whatever is necessary to help the customer solve the problem.

A GLANCE at the following pages of case histories of solutions of customer problems by power salesmen, whether it be improving industrial processes or through the saving of money arising from the substitution of purchased power for a customer's plant, is convincing evidence of the value of the consulting services of the power salesman to industry—a value that, measured in terms of the customer's own production, often exceeds many times the entire cost of power.

CASE STUDIES

1 Air Filtration Makes Possible Improvement in Optical Cement

2 Design Table Lights for Tire Inspection

3 Triple Production With Electric Heat

4 Ice Field Improves Creamery Load Factor

5 Analysis of Machine Schedules Improves Plant Billing Demand

6 Brick Company Saves Heat Formerly Wasted

7 Adopt Furnace Brazing for Automobile Heater

8 Power Factor and Lighting Improved in Boston Plant

9 Immersion Units Cut Can Soldering Costs

10 Electric Still Cuts Fuel Cost

11 Arc Furnace Changes Scrap Into Profits

12 Air Conditioning Saves Patent Leather Losses

13 Electric Heaters Cure Cement to Increase Brush Production

14 Power Salesmen Design Electric Steam Boilers

15 Electric Steam Boiler Serves Tire Moulds

16 Demand Control Scheme Lowers Power Costs

17 New England Paper Mill Profits by Power Interchange

18 Air Conditioning Yields Profits in Mushrooms

19 Plant Power Factor Raised to Reduce Billing Demand

20 Electrification Yields Profits for Brewery

21 Electric Bake Ovens Make Better Goods

22 Hold Plating Bath at Even Temperature

1 Air Filtration Makes Possible Improvement in Optical Cement

By K. B. CASTLE, Jr. • • • ROY P. WARREN
Rochester Gas & Electric Corp. Bausch & Lomb Optical Company
Rochester, N. Y.

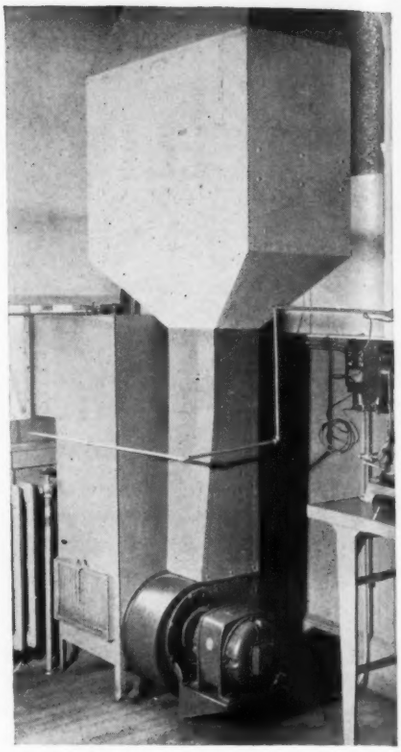
Research undertaken by the Bausch & Lomb Optical Company in 1935 to improve the quality of certain cements used on optical lenses so improved the method of manufacture that, but for one difficulty, the company believed it had a cement as perfect as it was practical to make. This difficulty was the presence of an occasional particle of dirt in the cement. Although exposed to air only 40 seconds during manufacture, it was believed that these particles probably came from air-borne dust.

In an attempt to overcome this difficulty the small room in which the cement was made was painted with a light coat of oil, oil cloth was cemented to the ceilings and walls, linoleum was put on the floor, windows were calked and strict rules were put in effect regulating people entering the room. As these steps produced little improvement the Rochester Gas & Electric Corporation's engineer on air conditioning was then called in to see if he could aid.

A dust count of not more than 500,000 particles per cu.ft., taken with a Bausch & Lomb dust counter, and no dust particle above 4 microns in diameter were assumed as conditions that would produce satisfactory results. It was decided to attempt to attain these conditions by careful filtering.

A small blower, handling 400 c.f.m., was installed to draw 200 c.f.m. from the room and the balance from the corridor outside the room. This air was blown through a Staynew standard panel felt filter at about one-half the rated capacity of the filter. This successfully removed the dust from the air, but liberated exceedingly small fibers of cotton. A 2-in. thick steel wool filter was then placed on the outlet side of the felt filter. At first minute particles of oil, about 2 microns in diameter, came off the steel wool filter, but after two days this ceased. Conditions settled down to a dust count of 400,000 per cu.ft., with practically nothing above 3 microns in diameter.

The air-handling equipment, exclusive of room preparations, had cost installed $167. Cement free of dust was immediately produced, with a monthly saving to Bausch & Lomb of several times this figure. Results of this experiment with exceedingly clean air were so gratifying that other operations were tried on an experimental basis in this room. As a result there are now a series of installations scattered throughout this plant, with more under consideration. A brief tabulation of the installations made during the year following the first experiment is given in the accompanying table.



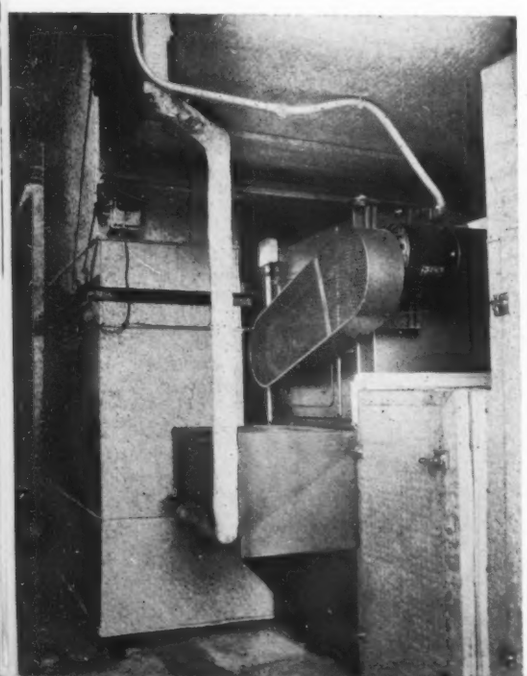
Filters remove dust particles one-fifth diameter of ragweed pollen

Equipment in laboratory where optical cement is made. Intake plenum chamber draws air from outdoors, adjacent corridor and from room, passing it through fan to filter housing.

Room	Type of Equipment	Function of Room
1. Chemical laboratory (Supersedes original room described above)	High degree of air filtering	Making optical cement, laminating sheets, assembly of optical instruments
2. Private laboratory	High degree of air filtering	Experiments in fusing glass and laminating lenses
3. Laminating room	High degree of air filtering	Laminating lenses
4. Engraving room	Temperature control to ± ½ deg. F. with commercial filtering.	Precise engraving of glass
5. Assembly room	Commercial filtering	Assembly of military equipment and telescopes
6. Cementing room	High degree of filtering and partial summer-time cooling	Cementing of lenses
7. Cementing room annex	Commercial filtering and summer-time cooling	Cementing of lenses for optical instruments
8. Hand polishing room	High degree of filtering and exact temperature control	Hand polishing of very precise lenses and prisms
9. Machine polishing room	High degree of filtering—provision made for adding complete conditioning	Machine polishing of lenses
10. Directors' room	Year-around air conditioned	
11. Large office room	Year-around commercial filtering plus heating	Bookkeeping and tabulating
12. Conference room	Year-around commercial filtering plus heating	Meetings and luncheons

Air filters and temperature control for lens polishing rooms

Right foreground shows filter section and Carrier "Weathermaker" for the hand polishing room. In the center the return duct from the machine polishing room rises to join the fresh air duct from the stack. Filter sections for this are in the extreme rear.



2 Design Table Lights for Tire Inspection

By J. F. GASKILL
Philadelphia Electric Company, Philadelphia, Pa.

Although inspection tables of a large tire manufacturing plant in the Philadelphia area were placed near windows where more than 100 ft.-candles of illumination were available, inspection of green tire casings was not satisfactory.

The inspector's problem was to detect air bubbles and blisters on both the outside and inside of casings. These he pricked with a vacuum hypodermic needle to remove the air. Bubbles on the inside were the hardest to detect and for satisfactory tire life were the most important to remove. If undetected, they produced "worm holes" between tread and cord, which were proved to cause many failures and short life.

The operation was carefully studied by utility lighting specialists and experiments in quality, quantity, color and directional character of light were made. It was found that the defects could best be seen by directing a light from an acute angle, almost parallel to the surface of the casing, which brought these defects into silhouette and made them more easily visible than with a more intense light from another angle.

A special inspection table was designed by the lighting engineer which employed a special trough that gave a line of light along the back edge of the table about 3½ in. above the top and directed across the surface to be inspected. This solution to the problem proved so satisfactory that the lighting specialists were given an opportunity to study two other similar inspection problems for this customer and help him in his solution.

3 Triple Production With Electric Heat

By M. H. GERHARD
Power Sales Engineer, Consumers Power Company, Kalamazoo, Mich.

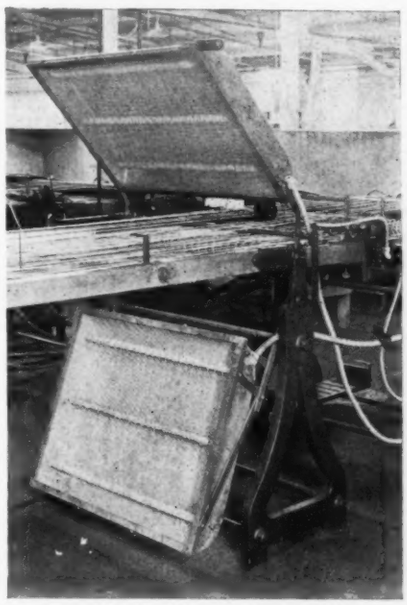
Faced with the alternatives of increasing production on its ruling machines or purchasing additional equipment, a printing concern in Kalamazoo, Mich., manufacturing tablet paper sought to develop a method of drying the ink faster on ruled paper so that it would not blot when cut and stacked as it left the ruling machine. Utility power engineers were called in to see whether a unit could be built that would produce a radiant temperature of 1,200 deg. F. across the width of the sheet of paper, as it was passing through the machine.

An open reflector heater of the type illustrated was built and connected so the heater would automatically cut off when the machine stopped, preventing the paper from scorching. Standard nichrome wire stretched between hooks was used, being fastened to asbestos insulated bars as shown in the accompanying illustration. The unit was designed to operate on 480 volts, each unit drawing 4½ kw.

With these heaters in place it was found that the ruling machines could be operated three times the original speed without having the ink blot. Fifteen machines were equipped with 9 kw. of electric heat on each machine, thus tripling the production on the fifteen machines.

Cost of the heaters was approximately $30 per machine. The small investment in the heaters saved a large investment in ruling machines as it would have required 30 additional machines to produce the same quantity of tablet paper now possible with the heaters.

This firm operates on a primary kva. rate which requires a good power factor to earn a low average per kilowatt-hour. By adding a 135-kw. load at unit power factor the over-all power factor was raised considerably, lowering the rate and making additional load inexpensive to operate.



Triple production of paper ruling machines by addition of electric heaters for drying ink

At left—Four and one-half kilowatts of nichrome wire in each of these two heaters produce a radiant temperature of 1,200 deg. F. on paper passing between them.

Below—Fifteen sets of radiant heaters in place on paper ruling machines.

4 Ice Field Improves Creamery Load Factor

By R. L. BAKER
Metropolitan Edison Company, Reading, Pa.

Creameries as a class of power customer frequently earn a relatively high rate per kilowatt-hour since their load factor is inherently low. In several such cases a power salesman has done considerable research work in order to devise ways and means of fully utilizing the important power-using equipment of the creamery—the refrigerating machine—with a view to improving the load factor.

One creamery customer was shown the advantages obtaining from the installation of an ice field to utilize fully his compressor capacity 24 hours per day, at least during the summer months. This resulted in production of 25 tons of ice per day, which was used in the creamery or

sold to farmers for icing their milk cans and for domestic service.

This arrangement made it possible for the creamery to secure milk with a materially lower bacteria count during the summer. The customer, processing and bottling 30,000 quarts of milk a day, now has an average utilization of 55,000 kw.-hr. per month during the summer and 30,000 kw.-hr. per month during the winter months, resulting in a high load factor and very low average rate. Several dairies are now using this idea, without affecting the ice manufacturers in the territory.

5 Analysis of Machine Schedules Improves Plant Billing Demand

A metal manufacturing plant in the Boston Edison territory having a connected load of some 2,500 hp. was being billed on the regular demand rate basis. About 300 motors were in service, together with three rotary converter sets that supply 220 volts d.c. for various drives. Since power factor varied from 70.6 to 78.6 per cent during the course of a year, it was desirable to seek a means for improving power factor and reducing demand.

The power sales organization and the customer investigated and found that substantial improvements could be effected by simple means. Analysis of the demand records of the load showed that the higher demands occurred daily between 7 a.m. and 8 a.m. and that the power factor varied between 68 and 76 per cent. It was recommended, therefore, that the customer's coal-pulverizing unit, driven by motors totaling 200 hp., be shut down before 7 a.m. to prevent its load overlapping that of the foundry and that one 200-kw. rotary converter be used during the daytime in place of one of the other 300-kw. units.

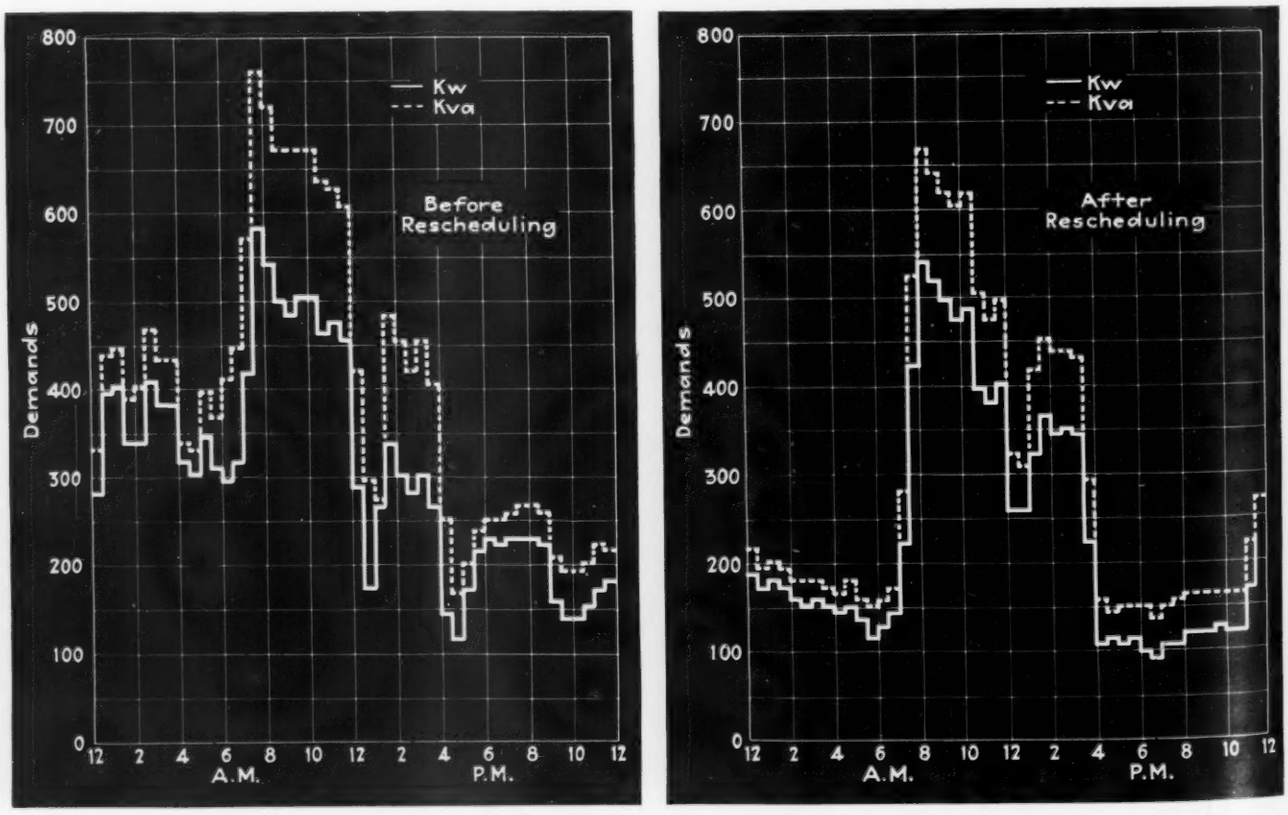
These changes were made and a recording demand meter purchased by the customer to enable him to follow constantly the peaks of his service and check against the handling and scheduling of factory equipment affecting power factor and demand. From the 68 to 76 per cent power-factor level the customer obtained in excess of 80 per cent by making the changes in procedure named. The billing demand shortly after making the changes in scheduling was 574 kw., the lowest for nine months, and this despite an energy consumption of 156,040 kw.-hr., the next highest consumption for a year.

Further opportunities for improvement as a result of the survey, should conditions justify them, include transfer of certain lighting and power loads from the direct current system to the alternating current system particularly in the core room; the use of a 10-hp. motor for carpenter shop drive, in place of a 20-hp. existing unit, and other reductions in motor capacity.

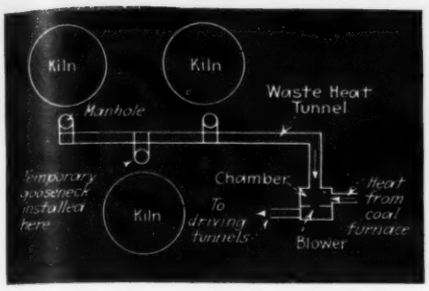
6 Brick Company Saves Heat Formerly Wasted

By FORD BATES
Nebraska Power Company, Omaha, Neb.

After standing idle for a number of years the Omaha yard of the Kritenbrinck Brick Company was put into operation, and the management requested the power company to make a plant survey. Since very little information was available on brick yard operation and the use of power and heat in a plant of this



Marked improvement in morning and evening demand condition follow rescheduling of operations



Waste heat from kilns during cooling forced into tunnels to dry green brick

type a trip was made to several well operated brick yards to observe the methods and machinery used. As a result recommendations following standard operating practice in other plants were made.

One recommendation called for the installation of a tunnel to convey waste heat from the kilns during cooling to a blower that directs it into tunnels to dry green brick. By adopting this suggestion heat which was previously wasted up the stack and through openings in the top of the kiln is utilized for approximately 2½ days after each burning, to dry new brick. It is estimated that the savings in fuel and labor approximates $20 for each burning, and in addition the kiln is cooled faster.

7 Adopt Furnace Brazing for Automobile Heater

By GLENN COLEY
Detroit Edison Company, Detroit, Mich.

Rejects are down to 1 per cent at the Detroit plant of Sunday Products Inc., maker of automobile hot-air heaters. A 257-kw. roller hearth electric brazing furnace is at least partly responsible for this condition, which is a considerable improvement over welding, the method formerly used.

The old type heater was made of straight tubes hand-welded to headers at each end. Material cost was double what it is now and the labor cost for welding considerably greater than for the present method of stamping machine assembling and brazing.

Assembly is now accomplished in three press operations, after which copper wire is placed at each joint to be brazed. About 6 oz. of wire is used for each heater. The heaters, which weigh 10 lb. each, pass through the brazing furnace at the rate of 150 per hour. The furnace uses about 1,000,000 kw.-hr. per year.

The header bell on the end of the heater was formerly welded, but now it rides through the furnace on a heater and the customer finds the furnace does not use any more energy with the bell than without it, so he declares that he is getting that operation for nothing. He also says: "We consider our present heater superior to anything we have built before and it just could not be made without copper brazing."

* From paper presented at Industrial Heating Course for Power Salesmen given by General Electric Company, September 20-24.

8 Power Factor and Lighting Are Improved in Boston Plant

Production conditions in a metal-working establishment on the Boston Edison system have been greatly improved by the co-operation of the power sales department with the customer along the line of modern lighting and power-factor correction. This concern began to use improved illumination in the shop office. The results were so satisfactory that when a new assembly room and shipping room were provided the layout was surveyed by the utility and units installed to furnish an average of 30 ft.-candles in the former and 20 in the latter.

The assembly room, about 46 x 37½ ft. and about 15 ft. high, is equipped with five 400-watt high-intensity mercury-vapor lamps mounted close to the ceiling and individually switched. Supplementary lighting which greatly improves the color values is furnished by a 500-watt tungsten unit. Glassteel diffusers are employed and two paint-spraying tanks at the rear are each lighted by four 200-watt tungsten lamps mounted in angle reflectors. These are mounted just inside the tanks, which incidentally are operated with interior walls surfaced with grease and lined with easily removable paper which facilitates cleaning and helps maintain maximum intensity of internal light ing for processing.

The shipping room has six 200-watt mercury-vapor lamps combined in each case with two 150-watt tungsten lamps for daylight effect. The mounting heights are about 12 ft. and color values highly satisfactory for the department's work. The room is about 48 x 32 x 15 ft. high, and the lighting units, as in the assembly department, illuminate with unusual effectiveness the traveling hoistway serving the division.

To correct the power factor, which it was desirable to maintain at a minimum of 80 per cent during periods of maximum demand (the old

Assembly room lighting is supplemented by 500-watt tungsten unit to improve color values

Analysis of Demands to Determine Capacitor Requirements

	Billing Demand	Corresponding Kw. Demand	Average Power Factor, %	Demand Reduction Power Factor, 80% or Better
June	110	75	54.5	35
July	110	76	55.2	34
August	106	73	55.1	33
September	109	74	54.2	35
October	112	74	52.8	38
November	119	84	56.5	35
December	125	97	52.0	28
January	121	97	64.0	24
February	126	93	59.0	33
March	126	88	55.8	38
April	130	87	53.5	43
May	125	83	53.0	42

Reduction represented by improving the power factor to 80 per cent 418 kw. at $2—$836 per year.

power factor ran from 54 to 64 per cent in a typical five months) 75 kva. in capacitors were installed in fifteen units at a central racking point. Rack capacity for an ultimate installation of 90 kva. was provided to meet future load increases. The installation of capacitors cost about $1,500 and the average saving is $864 per year, excluding the advantages of reducing heat losses in the factory wiring and the value of better voltage regulation at the motor-driven machinery. The saving in power bills is based on a demand charge of $75 per month for the first 30 kw. of demand or less, and $2 per kw. per month for the excess. The average load is determined for half-hour periods, and either the average kilowatt load or 80 per cent of the average kva. load, whichever is larger, is taken as the billing demand for the period.

The installation of capacitors paid for itself in less than two years.

9 Immersion Units Cut Can Soldering Costs

By W. C. PIERCE
Eastern Shore Public Service Company, Salisbury, Md.

Installation of three specially designed 5-kw. through-the-bottom, cast-in immersion units in each of ten 60-in. soldering pots at the Philips Can Company, Cambridge, Md., practically eliminated rejects, increased production from 200 to 300 cans per minute, reduced the amount of solder used and made possible a saving of some 50 per cent in the cost of heating over similar gas-fired equipment.

Operating temperature in the pots is now maintained between 600 and 610 deg. F by thermostatic control. The gas-fired equipment that was replaced by this installation operated at 650 deg. F., but the improved temperature distribution in the electric pots made a reduction in operating temperature possible. The lower temperature is expected to result in longer life for the crucible, a considerable reduction in dross and sludge and a corresponding reduction in radiation losses.

Heat is turned on the pot at 5:30 o'clock in the morning and the machine is placed in operation at 7 o'clock and runs until 3 o'clock in the afternoon. Over a period covering six full working days the power consumption of the soldering pot was 672 kw.-hr. Based on a charge of 1.7 cents per kw.-hr. the energy cost for this period was $11.42.

On an exactly duplicate gas-heated machine with the same working hours, the same production and the same size cans, the consumption of gas for the same period was 22,575 cu.ft. of 549 B.t.u. gas. This gas cost $1.04 for 1,000 cu.ft., or a total of $23.50; more than twice the cost of electric energy for the same service. Other advantages that have resulted from the installation of these heaters include:

1. Crucible life will be increased because of elimination of hot spots on the outside of the pots due to external gas firing. This reduced maintenance 15 per cent over a period of one year.
2. Temperature is automatically controlled, relieving the operator of this responsibility.
3. Rejects which formerly ran as high as ten per 1,000 cans have been cut to the point where no cans were rejeted in a 20-minute period.
4. Working temperatures are maintained at 5 deg. plus or minus and pots are brought up to temperature in 1½ hours.
5. Working conditions are greatly improved.

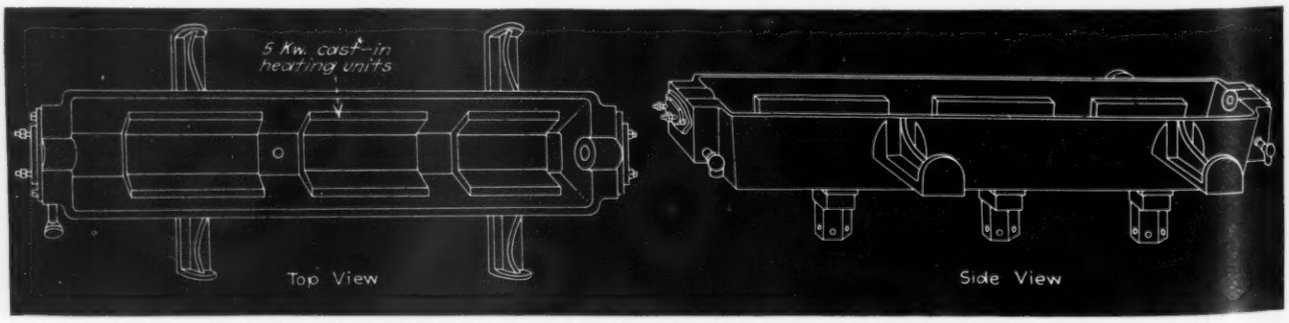
10 Electric Still Cuts Fuel Costs

By A. W. WALKER
Nebraska Power Company, Omaha

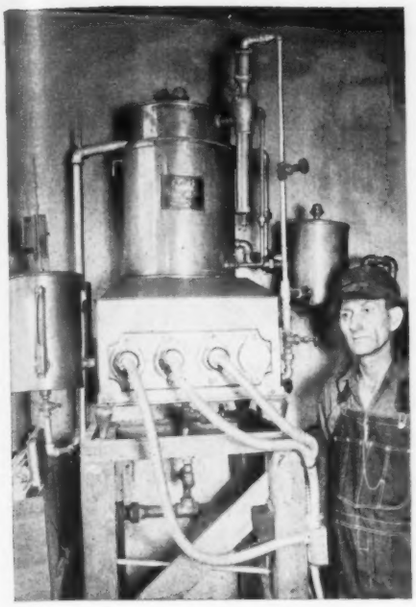
A 15-kw. electric water still has replaced a steam boiler and water condenser coil at the Omaha, Neb., plant of the Allen Ice & Water Cooler Service Company for the production of distilled water used by the trade. The former fuel-fired arrangement required ½ ton of high-grade coal per day costing approximately $12 per ton, together with attendant labor costs of $5 for a ten-hour day. This distillation equipment produced 300 gallons of distilled water.

The new electric still is connected to the main ice plant power service, taking advantage of a marginal energy rate of less than 1 cent per kilowatt-hour. The electric still yields an actual money saving over the fuel method, the importance of which, however, is secondary to the improvement in convenience and simplicity of operation. Output of the still is 5 gallons an hour. Occasional removal of scale from the pan below the three 5-kw. immersion heater is the only attention required.

Installation of the electric still was brought about when a power salesman



Through-the-bottom, cast-in immersion units in can-soldering pot, increase production 50 per cent



15-kw. electric water still saves over fuel-fired apparatus

in a routine survey of the customer's plant noticed the rather elaborate but somewhat antiquated fuel-fired distillation equipment and suggested the simplified electric method as being in order particularly due to the low power rate available.

11 Arc Furnace Changes Scrap Into Profits

By J. F. GASKILL
Philadelphia Electric Company, Philadelphia, Pa.

A manufacturer of centrifugally cast cylinders used as liners, sleeves and bushings was confronted with the problem of disposing of borings from his machining operations. He was unable to melt these in his fuel-fired furnaces, and because the scrap market for this metal, which contained valuable alloying elements, was low, he preferred to store this scrap rather than suffer a loss by selling it on the market.

A sizable tonnage soon accumulated and required space for storage that interfered with expansion. The customer had reached the point where it was desirable to turn the borings into profit, so he called on the power sales department for recommendations.

This proved to be an ideal application for an indirect arc furnace, which we, in co-operation with the furnace manufacturer, worked out with the customer. A furnace was purchased and in order to benefit by the most economical rate for a trial period the furnace was operated during off-peak hours. The operation was satisfactorily worked out, all borings were remelted and turned into centrifugal cylinders of better physical properties than by other melting methods.

In fact, the installation proved such a success that the production of stainless steel liners with this furnace was discussed with the customer. Production increased, a second furnace unit was installed and furnace operation was changed to a 24-hour basis in order to fill the demands for the sound, homogenous castings they were producing. Installation of the second furnace unit provided better melting facilities, greater flexibility for a 24-hour schedule, a very economical rate for power and a profit-making application for the customer.

Satisfaction with the assistance and service given to the melting problem led to further consideration of improvements in the customer's heat treating. A cylindrical type furnace was installed and provided with a control which was set for the higher temperature operations at night and operated at a reduced input during the day for lower temperature heat-treating operations. This type of control made it possible for the customer to prevent excessive demands and to result in a better plant load factor.

12 Air Conditioning System Saves Patent Leather Losses

By FORREST V. PAIGE
Sales Department, Boston Edison Company

Summer weather and high humidity presented the Colonial Tanning Company, Boston, with a serious problem in storing patent leather for subsequent distribution to shoe and luggage manufacturers. Above 85 deg. F. this sensitive stock tends to stick together as the highly surfaced sheets lie face to face. This causes scarring, scratches and impairment of finish, rejection from sale or return from customers. The sales department of the Edison company made a preliminary survey of the situation and as a result the Lawton Engineering Company of Boston installed a 20-ton General Electric air-conditioning system which has given much satisfaction to the purchaser, doing away with a labor cost of some $2,000 a year spent for turning over and airing hides by hand.

The refrigerating unit, located in the basement, consists of a 20-hp. motor, belt-driven compressor and a condenser unit mounted on a common base. On two upper floors, where the stock is stored, a duct system distributes the conditioned air through the stockroom. Cooling coils are installed in a horizontal central

Air-conditioned stockroom for patent leather saves over $2,000 a year in labor required to air out stock, besides preventing spoilage from sticking and cracking of sheets

plant air conditioner equipped with steam coils for heating in winter and two 0.5-hp. electric fans are provided for air delivery from the ducts on the two floors. Humidity is automatically controlled and adjustable thermostats on each floor enable the temperature settings to be set at desired points. Normal temperatures are maintained within 15 deg. F. of the external readings and relative humidities are usually kept around 40 per cent in summer and 50 per cent in winter. This prevents a tendency on the part of the patent leather to crack.

The stocks on hand normally vary between 500,000 and 1,000,000 sq.ft. and before the survey two men were kept busy all the time separating the sheet surfaces. This had to be done at least every ten days to prevent serious losses or injury to stock. In a typical twelve months' run the conditioning system consumed 16,484 kw.-hr., the maximum consumption being in July, with 6,128 kw.-hr. for that month. This gave about 915 hours' use of the connected kw. of the air-conditioning system, separately metered, in one year.

13 Electric Heaters Cure Cement to Increase Brush Production

By CHARLES L. STAPEL
Duquesne Light Company, Pittsburgh, Pa.

Having perfected a cement that would bind the fibers of buffing brushes and prevent brush explosions at very high speeds, W. S. Lang, general manager of the Pittsburgh Brush Company, attached the problem of production. Gas heat in a small baking room was tried for curing the cement, but because the bristles of tampico were easily discolored by heating a temperature low enough to avoid discoloration necessarily meant slow baking and a slow production schedule.

A suddenly increased demand for high-speed polishing brushes to be used in the automobile industry for burnishing plated auto parts made it necessary for this customer to turn out brushes much more rapidly, absolutely uniform in quality and at a considerably lower production cost or lose this market.

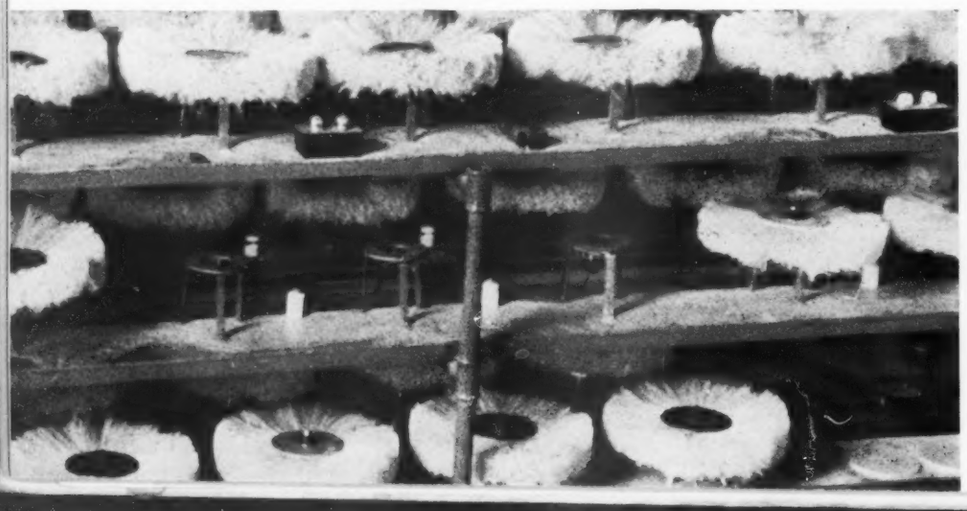
It was suggested to the customer that electric heat be tried for curing the cement. By experimenting it was found that ring heaters similar to the low heat sections of Chromalox electric range units would do the job. Metal clamps of the proper diameter and thickness were made to cover the impregnated cores of the brushes and these clamps were used to conduct the heat evenly over the area. Brushes to be baked are placed with the metal clamps directly on the ring heaters, which are supported firmly on a strip metal tripod as shown.

Forty-eight units are now in daily operation, each turning out a brush every 40 minutes. One hundred similar units will be added soon. The heaters are 600 watts, 230 volts, single phase and are connected in series, in groups of three, on the 220-volt, three-phase power service. Connection of these units in series results in each unit consuming about 60 watts, which meets the low temperature requirement of the job to be done.

Thermostats, like the one shown in the illustration, keep the heat at 170 deg. F., at which temperature a perfect job of baking is done. The cost of baking each brush is only slightly over $0.01, due to the efficient application of electric heat. Mr. Lang reports: "Because of this solution to our problem we have increased production. We now have uniform baking of brushes and entirely eliminated rejects that are caused by faulty baking. We have greatly reduced our cost of production."

Localized electric heating cures cement and solves brush production problem

In the center appear three of the heating units from which finished brushes have been removed. On the shelf above is one of the control thermostats



14 Power Salesmen Design Electric Steam Boilers

By J. E. BULLOCK *
Narragansett Electric Company, Providence, R. I.

When the Cocumcussoc Grille at Wickford, R. I., was faced with the problem of getting steam for sterilizing its 5-gal. ice cream freezer and its ice cream cans the local power company furnished it with information on factory-made electric steam generators of suitable capacity. But, because of recent heavy expenditures (it had just purchased all-electric cooking and water heating equipment), the company did not wish to invest the amount of money involved.

However, it did want an electric steam generator. The utility power sales department designed one and it was made locally. The resulting boiler is 12 in. in diameter, 48 in. long and is of welded construction. Heat is supplied by a 7.5-kw. immersion heater unit with automatic pressure control. To get the maximum flash capacity the water level is kept high and pressure is maintained at 75 lb. between sterilizing periods. Rate of use is governed by the degree that the steam supply valve is cracked.

This boiler had not been delivered when an order for a similar one came from a firm which supplies starches and gums to textile finishing plants. This concern uses its generator in a laboratory for testing by color quality the best gums for its customers' use. In this work it duplicates on a miniature scale exact conditions in various finishing plants which it supplies. A partner to the steam generator is a small electrically heated oven of 3 kw. capacity, in which the printed cloth to be tested is placed.

Because the presence of acid is

* From a paper presented at the Industrial Heating Course for Power Salesmen given by the General Electric Co., September 20-24.

sometimes required for the process the inner chamber of the oven is constructed of stainless steel. Four 500-watt strip heaters, thermostatically controlled, are clamped to the bottom of this chamber and two 500-watt strip heaters with three-heat control are clamped down on the top. The top heat is used to prevent the formation of condensate on the oven roof.

15 Electric Steam Boiler Serves Tire Molds

Steam for six vulcanizing molds, each capable of retreading a rubber tire in 90 minutes, is supplied at the rate of 225 lb. per hour in the Lewiston, Idaho, plant of the Idaho Motors Company by a 75-kw. electric boiler installed at the suggestion of power salesmen of the Washington Water & Power Company.

The boiler operates at 55 lb. pressure and is supplied with 440 volts, three phase. By sinking the boiler in an 8-ft. pit in the floor, working space was made available which would otherwise have been used to accommodate the sources of heat. This arrangement of the boiler in the pit is shown in the accompanying illustration. Pumps and traps were eliminated by the use of a closed return system.

Electric steam boiler serves tire-retreading molds

The installation, made in August, 1937, has been operating satisfactorily sixteen hours a day since that time and has considerably increased the efficiency of operation. Although electric heating elements could have been installed in the tire molds, it was felt in this case that the advantages of electric heat could be realized at lower cost through use of the boiler without going to the considerable cost of equipment replacement.

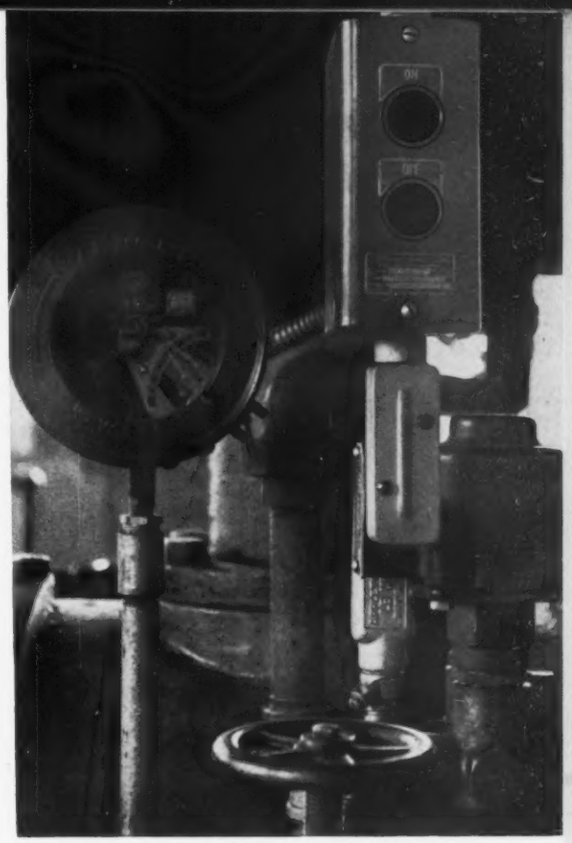
16 Demand Control Scheme Lowers Power Costs

By LEE SHELAIN
Power Engineer
Central Illinois Electric & Gas Company,
Rockford, Ill.

Graphic charts of demand conditions in a large Middle West industrial plant having a fifteen-minute peak demand of 730 kw. and an approximate monthly energy consumption of 204,800 kw.-hr. showed occasional peaks much higher than the average.

In the course of the investigation that followed, the customer, at the power engineer's suggestion, installed equipment to control these excessive demands. This equipment consisted of a contact-making wattmeter and a time-delay relay, with auxiliaries such as a Mercoid pressure switch and solenoid-operated unloading valve.

The contact-making wattmeter was set at a predetermined demand. When this point was reached and maintained for a period of 1½ minutes (the time for which the relay was set) a large motor-driven air compressor was unloaded. Thus advantage was taken of the capacity of the air receivers and the power demand for air requirements was smoothed out. The cost of this equipment was approximately $390, including installation. The first month it was in operation a saving in demand charges of $65.80 was realized.



Compressor unloader reduces demand charge

17 New England Paper Mill Profits by Power Interchange Agreement

By LAWRENCE M. DURYEE
Connecticut Light & Power Company, Waterbury

Confronted in 1936 with the need for increasing production and at the same time reducing plant operating costs to a minimum, the Setag Paper Company, Riverton, Conn., sought, among other things, a more economical power supply arrangement. Since continuous production of paper meant lower cost per pound, reliability as well as economy of power supply was important.

The plant, located on the west branch of the Farmington River, presented an interesting power problem because all energy was generated by steam engines supplemented by a waterwheel installation of varying output. No three-phase power lines had been available when the plant was built and the need for steam for drying machines had originally dictated the use of engines.

A survey by the local power company disclosed that a 75-hp., simple, non-condensing, steam engine was being used to drive one paper machine, the exhaust from this engine being used in the paper-drying rolls. A 250-hp. Ames Uniflow engine supplied power for the mill's main shaft, which drove one 1,000-lb. beater, one 600-lb. beater, one 15-hp. winding machine, a small lighting generator and miscellaneous pumps. This Ames engine was operated with an exhaust vacuum pump to reduce its exhaust pressure. Steam condensed in the vacuum pump was led to the river. The shafting was also connected to the waterwheels, each originally designed for 100-hp. output.

In making this power study the first problem was to determine the actual output of the waterwheels under existing conditions. Government water flow data showed that 10,000 kw.-hr. per month could be generated during the six summer months and 20,000 kw.-hr. per month during the six winter months, a total of 180,000 kw.-

Estimated Monthly Operating Costs, Private Plant vs Purchased Power, Setag Paper Company

Existing Operation—Plan A		Proposed Operation—Plan B	
Operating with all steam and water power, except 35 hp. of purchased power for the Jordan machine		Purchasing all power except 75 hp. of non-condensing engine, and available water power	
Kw.-hr. generated (mechanical)..	78,000	Kw.-hr. generated (mechanical)..	28,000
Kw.-hr. purchased (electrical)....	15,000	Kw.-hr. purchased (electrical)....	65,000
Total	93,000	Total	93,000
(Exclusive of water power generated)			
Plan A		**Plan B**	
Coal, 181 tons/mo. at $8.10/ton..	$1,465	Coal, 87.5 tons at $8.10 per ton..	$710
Maintenance on 250-hp. engine..	15		
Oil and waste for 250-hp. engine and pump.....	10		
Labor, three firemen at $96 each..	288	Two firemen at $96 each.....	192
Boiler maintenance: Forcing boiler caused renewal of saddle every three months or actual cost of $660 per year, which would be eliminated..	55		
Coal handling at $1.50 per day..	40		
Total operating cost.....	$1,873	Total operating cost.....	$902
Purchased power: 15,000 kw.-hr. per mo. and 30 kw. of demand for operating Jordan machine.....	276	Purchased power: 65,000 kw.-hr. and 140 kw. demand	923
Total plant expense.....	$2,149	Total plant expense.....	$1,825

Annual profit by electrifying ($2,149—$1,825) × 12=$3,888 per year.
(The increment purchased power cost, for 465 hours per month of demand, is $\frac{\$647}{50{,}000}$ kw.-hr.=1.29 cents per kilowatt-hour)

hr. per year. This power, competitive with the low bracket of 6 mills per kw.-hr. of the purchased power schedule, resulted in an annual value to the paper company of $1,080 per year. Because of the difficulty in obtaining continuous, uninterrupted output from the wheels no demand charge could be allowed as a credit for this power. The waterwheels could be counted on only for the production of kilowatt-hours.

Recommendations of the power company called for application of individual motors of 75 hp. to a second large paper machine which was to be put into operation, installing two motors of 50 hp. each for the two large beaters and purchase of two motors of 40 hp. for two small beaters. Recommendations provided further for the continued use of the 75-hp., non-condensing engine to supply power to the original paper machine, its exhaust steam to be used for the drying rolls. It was also proposed to revamp the waterwheels so that the theoretical 180,000 kw.-hr. could be developed. To this end the service of the power company's maintenance crew was offered at cost. It was further recommended that an induction generator of 100 hp. size be belted to the waterwheel shafting so that full use could automatically be made of all the water power possible.

Because of the low rate available for 24-hour service, it was suggested that all power for motors be purchased at 240 volts, three phase; that it be supplemented with the 75-hp. steam engine and the induction generator belted to the waterwheel, and that lighting transformers be installed to obtain efficient utilization of power for 120-volt plant lighting.

By the time this proposal was put into effect in September, 1936, the recommendations had been partially followed out. A 35-hp., three-phase motor had been installed to drive a Jordan, using approximately 15,000 kw.-hr. per month of purchased power.

Therefore, the power company survey data showed the expected monthly results given in the table.

With speed control of electric motors it was estimated that a minimum of 10 per cent increase in production would result. Since $13,000 worth of raw pulp was consumed each month, an increase of $1,300 of raw material rolled into paper would accrue. If a net operating profit, estimated even as low as only 10 per cent of the raw material cost, were used, then the value of the increased production would be $130 per month. This, added to the direct saving of $3,888 per year (see table) would make a total annual profit of $5,448 per year. This is conservatively estimated, omitting, as it does, the additional value of continuous service.

Other factors of benefit to the paper company are as follows:

1. Day and night fireman now has time for necessary maintenance work.

2. Superior paper, with less breaks, produced with constant-speed motors and uninterrupted service.

3. Flexibility of motor drive is possible. If the winding machine of only 7½ hp. needed to be run, for example, it can be done entirely independent of the remainder of the plant, with no engine attendance.

4. Interruptions of steam and hydro power are materially reduced under the plan.

5. Credit on compensation insurance by reduced boiler load. Boiler room hazard has been materially reduced by operating the boiler at its proper steam load.

6. More efficient supervision of personnel results because of labor-free operation of electric drive.

18 Air Conditioning Yields Profits in Mushrooms

By F. McQUILLAN
West Penn Power Company, Pittsburgh, Pa.

It costs three baskets of mushrooms from a daily production of more than a hundred to operate the air-conditioning installation recommended to J. S. Byers, Mt. Pleasant, Pa., by a power salesman of the West Penn Power Company. Since the installation has been made, however, it has been possible for Mr. Byers to supply mushrooms to the summer market when it is hardest to grow this type of produce and when prices are at their best.

Successful mushroom growing requires an even, low temperature and a relatively high humidity. The difficulty of obtaining this condition has always made mushroom growing a difficult summertime occupation.

Investigation in this case revealed that air conditioning could easily be applied to the building where the mushrooms were being grown since it was closed at all times and was already constructed in a way to lend itself to this addition. The air-conditioning system installed maintains a temperature of 55 deg. F. and a relative humidity of 80 per cent and permits Mr. Byers to operate twelve months of the year instead of seven, as was formerly the case.

19 Plant Power Factor Raised to Reduce Billing Demand

By D. E. WASHBURN
Power Sales Division, Boston Edison Company

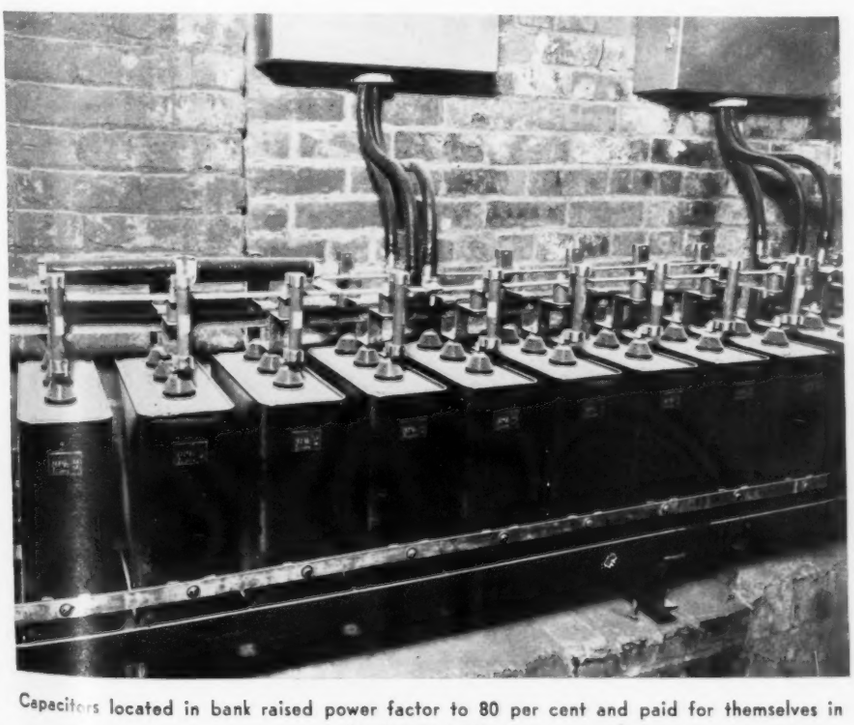
Through the co-operation of the Raytheon Production Corporation, Newton, Mass., and the Power Sales Division of the Edison Company, following a study of loads and manufacturing conditions at this radio tube plant, economies in the use of service were realized which will pay for an investment in power-factor corrective equipment of $2,000 in about fourteen months.

The Raytheon company purchases about 250,000 kw.-hr. a month. Energy is purchased at the Edison high-tension rate and the total connected load on the Raytheon company substation is about 1,000 kw., including about 600 active electric welders of 0.5 and 1 kva. rating (used in welding filaments, plates and grids). It was important to reduce the billing demand without impairing the service to the plant in any way.

The plant power factor was about 70 per cent in February, 1937, with a billing demand of 995 kva. (taken at 80 per cent of the kva. according to the rate schedule). Variations in loading resulted in improvement of power factor in subsequent months up to 76.1 per cent and an 857-kva. billing demand by May, but analysis of the conditions showed the desirability of installing 225 kva. in capacitors, fifteen General Electric units being placed in the substation near the service entrance. These were wired to permit using five, ten or the full bank, according to corrective conditions needed.

The company also does some welding and possesses a battery of twelve large electric welders of about 825 kva. combined rating, but these did not enter materially into the operating picture this summer, though their effect was considered in determining the capacitor rating necessary. The capacitor installation complete cost this industrial customer about $2,000.

All reductions in demand by improved power factor result in a saving to the Raytheon company at the rate of $1.50 per kilowatt. The installation of capacitors improved the voltage regulation throughout the factory and also provided increased margin of carrying capacity in the internal wiring through reduction of idle heating current. The June demand was 823 kw. maximum, against 868 kw. in February, and the July demand, 796 kw., the power factor somewhat exceeding 80 per cent in each month. Of the total load of the plant, lighting service accounts for about 20 per cent, motor service for 30 per cent and heating, welding and high-frequency heating equipment for 50 per cent.



Capacitors located in bank raised power factor to 80 per cent and paid for themselves in fourteen months

20 Electrification Yields Profits for Brewery

By F. McQUILLAN
West Penn Power Company, Pittsburgh, Pa.

Since considerable capital was needed to recondition the plant of the Jones Brewing Company, Smithtown, Pa., and to purchase kegs, cases and supplies, only a small fund was available to modernize power equipment. Consequently when operations started the boiler plant was carrying a terrific overload and the steam-driven compressors and generators could only be classified as "steam hogs."

This situation was noticed by the power salesman, a careful survey was made and a program developed which would entail a minimum of investment and would allow the company to follow a "modernize as you earn" scheme. This program proposed the policy of electrification that follows:

1. Transfer all lighting from an engine generator to utility service.
2. Replace steam-driven generator with motor-generator set.
3. Install electrically driven ammonia compressor for cellar cooling to replace steam-driven compressor.
4. Substitute electrically driven centrifugal pumps for steam-driven pumps.
5. Replace steam-driven ammonia compressor for peak usage with an electrically driven ammonia compressor.

To date three of these steps have been taken, with the following results:

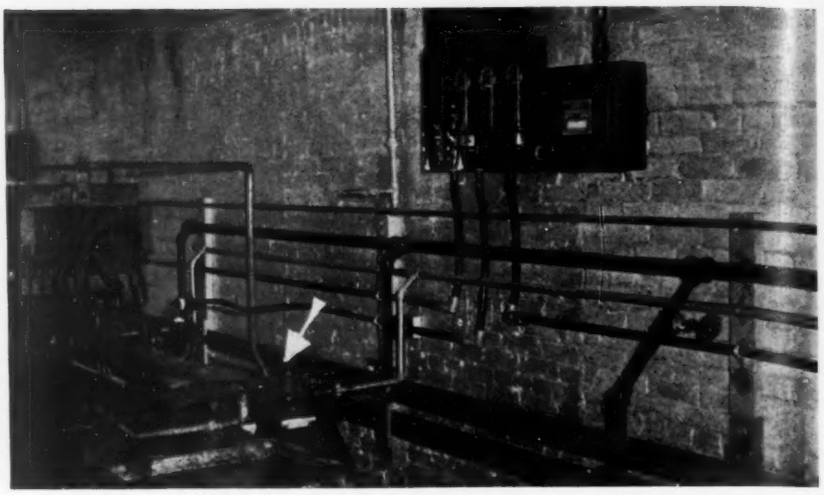
Transfer of lighting from the engine generator to utility service has been accomplished at a minor cost of wiring. This reduced the operating hours of the engine generator from 24 to eight per day.

With the installation of a motor-generator set to supply the d.c. load a material reduction has been made in the amount of steam which the boiler house has to supply. The engineer reports a tremendous reduction in coal requirements and complete relief from the overloaded condition in the boiler house.

An electrically driven refrigerating compressor for cellar cooling is now

being installed which will operate at all times when process steam is not needed. Boilers will be banked sixteen hours a day and on week-ends. Electric equipment, with only minor attendance, will carry all of the load during those times.

More than half of the plant power equipment has been modernized to date. The capital layout for this work has been very small since it has been possible to modernize as funds became available. Instead of an overloaded plant this company now has boilers which are operating below their capacity, insuring longer life for the boilers. The major capital investment feared two years ago will not have to be made.



Lead-covered immersion heaters keep chrome plating bath within ± 2 deg. of critical temperature

21 Electric Bakeovens Make Better Goods

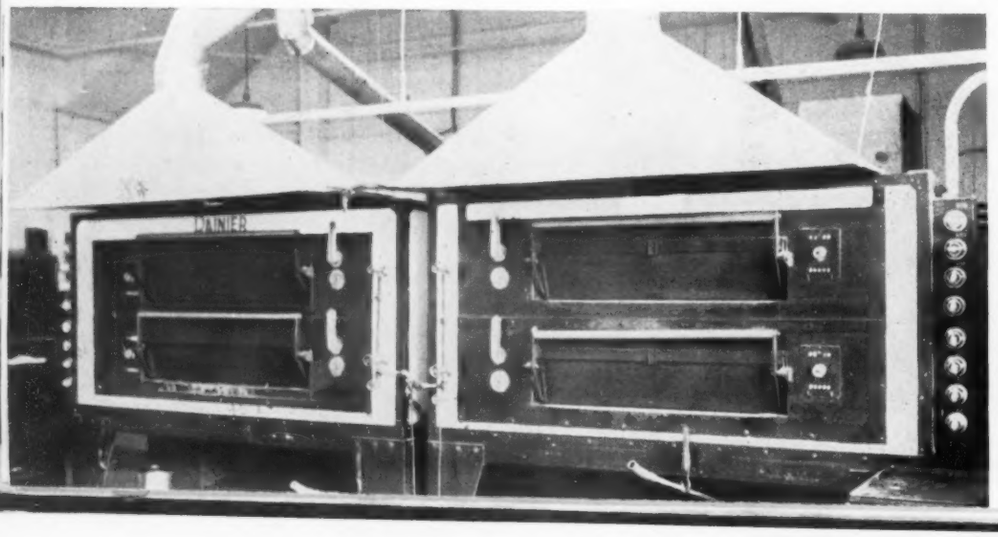
With the purchase of the Chatterton Bakery, Seattle, Wash., in 1929, Van Kamp's Holland Dutch Bakeries, Inc., undertook an extensive expansion program that called for installation of additional baking equipment. The existing plant was equipped with a 35-kw. electric oven and two gas-fired ovens.

The management, however, was undecided whether to put in electric or gas ovens. It requested a proposal from the power sales department of the Puget Sound Power & Light Company covering the operation of electric ovens that would meet its requirements.

It was demonstrated that by installing additional electric baking equipment a much lower rate per kilowatt-hour could be obtained that would be somewhat lower than the average cost of gas per 1,000 cu. ft. Proposals covering the operation of electric equipment were finally accepted and during the ensuing year one 95-kw. bakeoven, one 20-kw. pastry oven and one 30-kw. pastry oven were installed.

As a result of the installation the actual average rate per kilowatt-hour is lower than the cost of gas used in gas-fired equipment. The management has been well pleased with the electric ovens and has stated that the products which have been turned out more than meet the rigid requirements as to quality and texture.

Electric baking ovens turn out better products



22 Hold Plating Bath at Even Temperature

By M. H. GERHARD
Power Sales Engineer
Consumers Power Company, Kalamazoo, Mich.

For many years prior to its installation of electric immersion heaters the Kalamazoo Plating Company used steam to heat the chrome plating tanks. Thermostatically regulated solenoid valves were used to maintain a temperature in the region of 108 deg. F., but this involved a temperature lag of ±4 deg. An excellent job of chrome plating can be done when the temperature is maintained at 108 deg. F. If, however, the temperature falls more than 2 deg. F., the work is spotted and plating uneven. If the temperature rises more than 2 deg. F. the plating is gray and is also hard to buff.

At the suggestion of the local utility power sales department an attempt was made to obtain better temperature regulation by installing lead-covered immersion units in conjunction with close thermostatic control. Three tanks were in use, one of 800 gal. capacity and two of 300 gal. The 300-gal. tanks were equipped with 6-kw., 460-volt units which were grounded to the tank. Two 6-kw., 230-volt units connected in series on 460 volts were installed on the 800-gal. tank. Thermostat bulbs were covered with thin lead pipe and also were grounded solidly to the plating tank.

The thermostatically controlled heating units operate within ± 2 deg. and eliminate the lag and lead usually experienced with other kinds of heating. Since the temperature difference between the room and tank is very small, units are not turned off at night and the thermostats keep the temperature at 108 deg. at all times.

Results obtained over the last two years are very satisfactory, the product has been greatly improved and a saving of 25 per cent in the cost of supplying the heat has been realized. At the present time this concern is installing two more large chrome tanks with electric immersion units.

Analyze Enameling Costs of Electric vs. Fuel Furnaces

Successful Promotion of Electric Furnace Enameling Lies in Careful Analysis of Comparative Fuel, Material, Labor, Maintenance Costs on a Finished Product Basis

By H. J. BABCOCK *
Electric Heating Specialist Tennessee Electric Power Company, Chattanooga, Tenn.

IN SELLING electric furnaces for firing porcelain enamel each furnace or power salesmen must answer the question, Where are savings made with an electric furnace as compared to one heated by the combustion of fuel? Those engaged directly or indirectly in the sale of such furnaces are thoroughly convinced that the steadily increasing use of electric heat in enameling plants must have demonstrated in a practical way that it will save money. But beyond pointing to those users of electric furnaces who are operating successfully as evidence that savings are being made, how is that pertinent question to be answered?

Advantages numerous

If the sales presentation of the advantages derived through the use of an electrically heated box-type furnace for firing porcelain enameled ware are analyzed the major advantages would probably be summarized as follows:

1. Electric furnaces permit more rapid heating up or cooling down, thus saving in energy cost and labor cost as well as showing intangible savings due to meeting peak production or short shipment requirements.
2. Electric furnaces permit loading a greater average hearth area with sheet steel and a greater proportion of decks with cast iron, saving in labor and energy costs, increasing production per average hour and lowering over-all cost per unit of ware.
3. Electric furnaces have fewer firing troubles to cause interruptions or slowdowns in productive capacity, thus saving losses due to idle hours, lowering energy cost and increasing productive capacity per furnace per year, with lower over-all cost per unit of ware.
4. Electric furnaces show a lower over-all repair and maintenance cost per furnace unit per year.
5. Electric furnaces automatically maintain uniform, non-variable temperature throughout the firing chamber, thus increasing the percentage of first-grade ware, decreasing supervisory costs and lowering energy, labor and material costs.

These advantages, so the salesman states, if expressed in terms of overall costs of production per unit of ware, would show an average cost with the electrically heated furnaces which in most cases is lower than with similar fuel-fired furnaces.

These are outstanding advantages in favor of the electric furnace. On the basis of them, assumption can be made regarding production, hours, etc., to give an approximate cost comparison. But there are difficulties in the way of making these assumptions that detract from their value unless statements are backed by evidence from operating records. In each section of the country where enamel plants are in operation, in each division of the enamel industry, in fact, in each individual enamel plant, there are different production conditions, different size, thickness and weights of ware, different grades of ware, different labor rates and hours, etc. These variables make it difficult to give any general answer to this question. But in each section of the country it may be found that most of these conditions are pretty well standardized within any division of the enamel industry. Perhaps salesmen have been overlooking a forceful bit of sales data that operating cost records would give them to back up their statements.

If these assumptions are correct, the advantages of the electric furnace should show up in these records. If a section is picked in which a number of plants are located all doing work of a nature more or less similar and all using the same size furnace, it is entirely possible that some indication may be obtained from the cost records to show that advantages are reflected in savings made with electric furnaces if a comparison is made between plants having only oil-fired furnaces, those having only electrically heated ones and others that have both kinds.

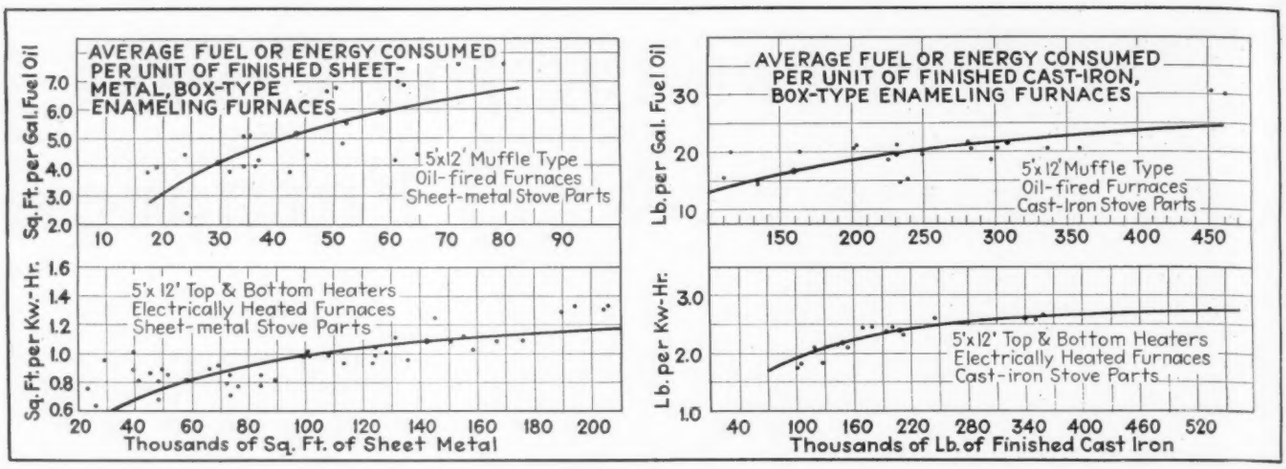
Obtain operating data

With these assumptions in mind, a section of the country was picked from which data were obtained for enamel plants using oil-fired muffle or electrically heated box type furnaces with 5 x 12-ft. hearths. Data consisted of detailed records in monthly totals for twelve consecutive months for finished ware, fuel or furnace power, auxiliary power, direct labor hours for firing ware, furnace hours and then cost data covering materials, fuel, power, direct labor and total production.

Most of the information generally available heretofore has dealt with average hourly fuel or power consumption in terms of a single coat of enamel fired on a given quantity of ware. We seem to have followed in the footsteps of the furnace engineer and dealt mo tly in the furnace rating that is derived from the engineering estimates offered by furnace-building companies.

Due to the many variables involved in the use of a furnace, it has become customary to adopt a conventional

* Paper presented at Industrial Heating Course for power salesmen, held by General Electric Company, September 20-24.


AVERAGE FUEL OR ENERGY CONSUMED PER UNIT OF FINISHED SHEET-METAL, BOX-TYPE ENAMELING FURNACES
Sq. Ft. per Gal. Fuel Oil
5'x12' Muffle Type Oil-fired Furnaces Sheet-metal Stove Parts
Sq. Ft. per Kw.-Hr.
5'x 12' Top & Bottom Heaters Electrically Heated Furnaces Sheet-metal Stove Parts
Thousands of Sq. Ft. of Sheet Metal
AVERAGE FUEL OR ENERGY CONSUMED PER UNIT OF FINISHED CAST-IRON, BOX-TYPE ENAMELING FURNACES
Lb. per Gal. Fuel Oil
5'x12' Muffle Type Oil-fired Furnaces Cast-Iron Stove Parts
Lb. per Kw-Hr.
5'x12' Top & Bottom Heaters Electrically Heated Furnaces Cast-iron Stove Parts
Thousands of Lb. of Finished Cast Iron

method of expressing its capacity in terms of maximum output in pounds of ware fired with one coat (usually ground coat) at a specified maximum temperature in a period of one hour when the furnace has reached thermal equilibrium. Under this fixed condition an estimate of fuel or kilowatt-hour consumption for that one hour is given. The furnace engineer needs thus to reduce his problem to one of maximum load at maximum temperature during one hour.

In the case of fuel-fired furnaces there are variables not present in those electrically heated. They are those involved in the combustion of the fuel and utilization of the heat produced, such as variable chemical composition and physical properties of the fuel, atomizing or air-mixing effectiveness of the burners and ports depending on their mechanical condition, arrangement as well as mechanical condition of combustion and stack areas as they affect the utilization of heat, temperature and humidity of the air used for combustion, pressure of both air and fuel delivered at burner aperture, change in the ratio of air to fuel away from that required for complete combustion, etc. When making an estimate of fuel consumption, the fuel furnace engineer carries his assumption of fixed conditions to the point where all these variables remain constant, also.

Rating no index of performance

It is well known that this rating is not a measure of the performance of the respective furnaces under all the varying conditions of plant operation, nor does it represent any definite measure of the units of finished ware that it will produce under normal operating conditions. If power salesmen, thinking in terms of load factor, maximum demand and rates per kilowatt-hour, permit themselves to be drawn into a discussion based solely on the estimates in the proposals covering the respective types of furnaces, they cannot reduce power costs to terms that have any relationship to the unit of production which the enamel plant operator uses as his cost basis. Although of value to the furnace engineer, this conventional method of estimating does not help the power salesman. Furthermore, it permits the fuel-fired furnace to be presented under conditions which it rarely attains in practical operation. And it encourages the prospective purchaser to accept these estimates of consumption of fuel or energy as an actual measure by which cost comparisons may be made.

Why not "talk the language" of the enamel plant operator instead of that of the engineer? He is a business man who deals in square feet of sheet steel or pounds of cast iron which have been coated with porcelain enamel to produce ware of a quality suitable for sale. Some of the ware has one coat, some has two, three or maybe more, but he does all his figuring in total "finished feet or pounds," regardless of the number of coats. It is for this reason that the data are presented in terms of finished ware produced per month or per year.

Let us look now at what was found in the data from the enamel plants using oil-fired muffle and electrically

[*Continued on page 140*]

Table I—Average Annual Totals Sheet Steel

Finished in Oil-Fired Muffle Type Furnaces

Totals	Gallons	Averages	
Oil consumed	70,357	14.5	gallons per hour
Firing hours	4,852	97.6	sq.ft. finished per hour
Operating days	254	6.75	sq.ft. finished per gallon
Sq.ft. finished	474,645	48.8	sq.ft. finished per labor-hour

A — Finished in Electric Box Type Furnaces — Low Production

	Kw.-Hr.		
Power consumed	456–800	195	kw.hr. per hour
Firing hours	2–346	159	sq.ft. finished per hour
Operating days	212	0.82	sq.ft. finished per kw.-hr.
Sq.ft. finished	372,384	79.4	sq.ft. finished per labor-hour

B — Finished in Electric Box Type Furnaces — Normal Production

	Kw.-Hr.		
Power consumed	1,113,600	289	kw.hr. per hour
Firing hours	3,826	281	sq.ft. finished per hour
Operating days	235	0.97	sq.ft. finished per kw.-hr.
Sq.ft. finished	1,073,606	140.5	sq.ft. finished per labor-hour

Table II—Average Annual Totals Cast Iron

Finished in Oil-Fired Muffle Type Furnace

Totals	Gallons	Averages	
Oil consumed	124,630	10.2	gallons per hour
Firing hours	12,190	166	lb. finished per hour
Operating days	255	16.2	lb. finished per gallon
Pounds finished	2,018,880	110	lb. finished per labor hour

A — Finished in Electric Box Type Furnaces — Low Production

	Kw.-Hr.		
Power consumed	285,400	96.5	kw.-hr. per hour
Firing hours	2,933	273.6	lb. finished per hour
Operating days	244	2.94	lb. finished per kw.-hr.
Pounds finished	840,104	182.4	lb. finished per labor-hour

B — Finished in Electric Box Type Furnaces — Normal Production

	Kw.-Hr.		
Power consumed	638,100	156	kw.-hr. per hour
Firing hours	4,122	472	lb. finished per hour
Operating days	184	3.05	lb. finished per kw.-hr.
Pounds finished	1,944,858	314.6	lb. finished per labor-hour

August Brings Utility Gains

Revenue sets new record for the month 7.3 per cent over 1936 — Output and sales are larger than ever before — Domestic use grows rapidly

Energy production in the electric power and light industry in August rose to a new all-time record of 10,099,041,000 kw.-hr., exceeding last year's figure for the like month by 10.2 per cent, and revenue from ultimate consumers rose to $182,057,200, a new high-water mark for the summer month 7.3 per cent above 1936, according to statistics announced by the Edison Electric Institute.

The revenue was 1.3 per cent greater than in July and 4.5 per cent above May, which was the year's low point in the annual cycle. The increase over 1936 is close to the average for the four preceding months. This, of course, affords no measure of the increase or decrease in net earnings, since the latter item is affected by increases in wages, in other operating costs and in taxes, on which statistics are not available.

Rates continue downward

Total energy sales to ultimate consumers also were larger than in any other month, up 11.9 per cent over August, 1936. Meanwhile the average revenue per kilowatt-hour of all classes of consumers trends steadily downward. During the year it fell from 2.19 to 2.11 cents, a decline of 4 per cent. Also, the yearly rate of advance in energy sales has been gradually slackening from the 18.9 per cent of last March.

As appears from Table II, a good pace has been maintained in consumption by the three major groups of customers. Industrial use has climbed to new high levels in every month since March. Energy for domestic use is mounting rapidly and for three consecutive months the gain over a year ago has exceeded 17 per cent. Sales in this group are now above the winter peak of 1934-35, although August is one of the low months of the year. Retail commercial sales continue more than 13 per cent above a year ago.

Rates for domestic consumption are still falling. The average for the latest twelve-month period was 4.49 cents per kilowatt-hour, down 6.8 per cent compared with the rate a year ago, while the average consumption per customer rose 10.2 per cent to 777 kw.-hr. During the same interval nearly 714,000 domestic service customers were added, an increase of 3.3 per cent.

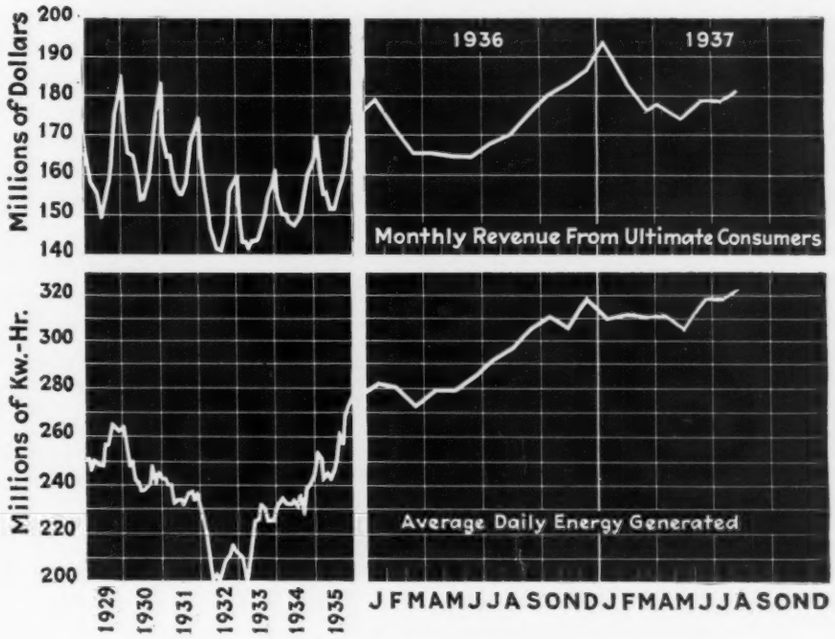


Table I—Monthly Revenue from Ultimate Consumers and Energy Output of the Electric Light and Power Industry

Compared with Corresponding Month of Previous Year

Month 1937	Revenue from Ultimate Consumers‡		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
August	182,057	+7.3	10,099	+10.2	3,028	+10.3	7,071	+10.3
July	179,637	+7.1	9,865	+ 9.1	3,160	+12.1	6,705	+ 7.8
June	178,539	+8.9	9,563	+12.4	3,491	+19.0	6,072	+ 9.0
May	174,287	+6.3	9,459	+11.9	4,103	+15.5	5,356	+ 9.3

* By courtesy of Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises. ‡ Edison Electric Institute.

Table II—Allocation of Energy by Classes of Service, 1937

Compared with Corresponding Month of Previous Year (Edison Electric Institute)

Class of Service	August		July		June	
	Millions of Kw.-Hr.	Per Cent Inc.	Millions of Kw.-Hr.	Per Cent Inc.	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution *	10,352	+11.6	10,113	+10.4	9,819	+13.6
Lost in transmission, etc.	1,707	+ 9.9	1,657	+ 0.8	1,492	+ 8.4
Sold to ultimate consumers	8,645	+11.9	8,456	+12.5	8,327	+14.6
Domestic	1,382	+17.1	1,371	+18.2	1,342	+17.3
Com'l, small light and power	1,539	+13.1	1,497	+13.7	1,463	+14.8
Com'l, large light and power	5,071	+13.0	4,944	+13.4	4,889	+16.5
Municipal street lighting	154	−18.2	140	−18.1	136	−14.5
Railways — street, interurban	326	− 4.0	333	− 2.8	327	− 5.6
Railroads — electrified steam	97	− 0.6	100	+ 1.7	98	+31.1
Municipal and miscellaneous	76	+ 7.4	71	+ 3.1	72	+ 5.3

* Generated, purchased from other sources, imported, less energy used in railway and other departments.

Editorials

Voters Turn Down Municipal Ownership

MORE and more frequently do we find indications that the people are beginning to lose faith in the promises of "cheap electricity" made by politicians. Partial returns from several cities indicate that municipal ownership was snowed under this week wherever it was on the ballot.

From Iowa in the past year have come several reports of local elections in which the voters have overwhelmingly recorded their distrust of municipal utility operation and affirmed their belief in better service and lower rates from private companies. And comes now from Kansas the report of the most positive repudiation of government utility operation probably yet recorded.

We quote from the Emporia *Gazette*:

"With a majority unprecedented in any city election the citizens of Hamilton voted almost unanimously Tuesday (October 12, 1937) to sell their electric distribution system to the Kansas Electric Power Company. Of the 220 ballots cast, 202 voted to sell, 17 were against and one ballot was thrown out."

National and state governments owe election pretty much to the rural and small-town vote. For this reason much encouragement for the private utility cause can be derived from the several recent decisions by the voters against municipal utility ownership.

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Another Big Opportunity for Better Lighting

UNREMITTING efforts to prevent industrial accidents have reduced the frequency rate of injuries by 61 per cent since 1926. Out of every five persons who would have been disabled under 1926 conditions only two were actually disabled in 1936. That is a record to be proud of.

But the loss during 1936 of nearly six billion man-hours due to injuries is still an appalling price to pay for our industrial civilization, whether considered in terms of money or human suffering. That was the toll paid in 1936 by companies reporting to the National Safety Council.

How the accidents resulting in these injuries were distributed as to type is not stated, but detailed statistics from industrial commissions in five states are probably typical. The latter show about 15 per cent ascribed to falls to the same level and to stepping on or striking objects. Assuming that the average loss of time per injury is the same in this group as in all industries, they cost 900,000,000 man-hours.

Why do men stumble or step on obstacles or run into obstructions? Commonly because they do not see them. Inadequate lighting is, then, an important contributing cause in this type of accident. In addition it is doubtless in many instances a factor in other types, among them falls to another level, injuries by machinery or hand tools, falling objects.

Here is an opportunity for the further reduction of an enormous waste which calls for the services of the specialist in illumination. The remedy is not necessarily more light, but better light, better contrasts, less glare; in other words, clearer vision. It is even possible that some of the new technique applied to highway lighting might be adapted to floor lighting in order to prevent accidents.

•

Engineers Condemn Wasteful Public Works Spending

ELECTRICAL engineers generally will welcome the extent to which other engineers are rising to question the economic soundness of the New Deal power program. President-elect Riggs of the civil engineers and their past-president, Mead, have gone on record, and more recently President Harvey N. Davis of Stevens Institute of Technology in a speech to the mining and metallurgical engineers refuted some vulnerable assertions of Walter Lippman. The latter had said that "society cannot be planned and engineered as if it were a building, a machine or a ship." Only irresponsible technocrats have any ambitions in that direction. All that wholesome engineers want is that the same rigorous test of economic justification be applied to bureaucratic extravaganzas as are applied before private funds will engage in comparable enterprises. Under such a test most of the government's power program would crumble, and rightly so.

It will be surprising if these other engineering groups are not accused of being the propagandists and protagonists of some obscure enemy of the New Deal. Certainly if the American Institute of Electrical Engineers made similar criticisms it would run the risk of being so accused. That is why the Institute has stayed out of it in a national sense. The squandering of public money, although much of it is used to build

power projects and "yardstick" electric service, is not an electrical matter at all. It is a matter of concern to all engineers because the governmental projects violate the economic principles common to all engineering fields. Political expediencies, pork barrels and grudges are accorded no weighting in engineering analyses, and that is why politicians relish the engineer's reticence about inviting himself into the discussions.

Local sections of the various societies, single and jointly, have, however, become active in questioning the soundness of many of the federal enterprises, and now, also, we begin to have them doing it at national meetings. These are significant indices that engineers are beginning to acquire a unified group consciousness permeating down through the ranks to a degree not heretofore attained by the activities of American Engineering Council. That embracive organ of engineering thought is thus rendered more than ever competent to take the initiative in checking the wisdom of federal ventures, with assurance that the rank and file of engineers are participating in conscious and active sympathy.

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Network Analyzer Averts Unwise System Increments

INTERCONNECTION building is being resumed, and there is sure to be more of it as loads increase and justify more capacity and a new distribution of reserves. Ahead of the construction must be the analysis and the planning which assure that each line really makes the contribution expected of it. When systems were simple it was sufficient to build an adequate line in the appropriate area. With the complexity that has been reached in many cases this is no longer safe, because the energy and inductive currents do not always choose to follow the routes and directions desired for them. Nor are such experiences confined to a few of the large intricate systems—they can happen in almost any network.

Computations can be made, but they are laborious if they are extended to embrace all likely configurations of connections and combinations of loading. The alternating-current network test board short circuits months and years of tedious figuring. Not only does it give the answers with ample accuracy but it also discloses many eventualities that an engineer might not live long enough to compute.

One hears of cases where a superposed unit at some logical point would prove less effective than a synchronous condenser elsewhere, of instances where a projected line would not work as desired without corrective equipment of some sort to regulate power flow, and of other cases where interchange behavior could be made to conform to contractual stipulations only under uneconomical operating restraints or outlays. The right answer is going to be found by setting up a replica of the system in miniature and subjecting it to all reasonable eventualities. This is just what the network analyzer does. It serves an insurance function in guarding against unwise expenditures for system reinforcement.

•

Commercial Selling Talk From a Commercial Customer

FOR many years at utility gatherings there has come up for discussion ways and means of "educating the customer," but a few weeks ago one of the customers—a commercial customer—spoke on the program of the newly organized national Commercial Electric Cooking Council, his subject being: "Why I Cook Electrically." At the conclusion of his talk it was noted that the customer had said nothing about the costs of his electric cooking. Whereupon, one of the utility men present said: "Mr. Wheeler, what proportion of your total expenses is taken by your electric cooking bill?"

"I don't know," said Customer Wheeler, "and I really don't care very much because, you see, the food saving is so much larger than the electric bill."

Call it, if you please, a customer "educating" the company, but there, in a nutshell, is the kind of sales talk that will sell commercial cooking. It is probably necessary to demonstrate that where cooking by coal costs 2.65 cents per meal, or by gas costs 2.85 cents per meal, the cost the electrical way is only 1.65 cents per meal. But from there on out, listen to Customer Wheeler as he talks to the utility representatives about what interests him as a customer.

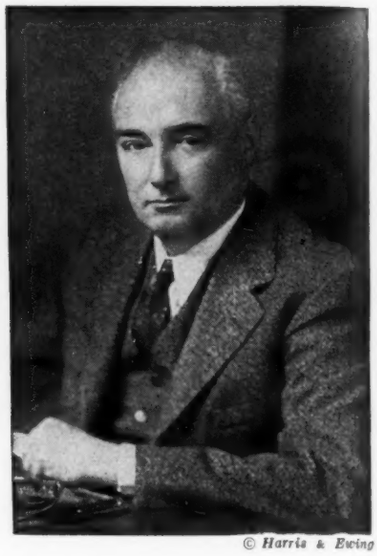
"Our restaurant cooking installation has sold ten or a dozen jobs," he says, "to restaurants of manufacturing companies and hospitals. These people come to see me and I tell them electricity costs less if it is used properly. My portions are better and my menu prices are lower due to electric cooking. My savings over the cost of replacing and maintaining coal-fire grates and being able to keep my restaurant in continuous operation are real reasons for cooking electrically."

Still the words kilowatt, kilowatt-hour, demand, energy component or electric rates have not been mentioned even once.

Those representatives of forty utility companies, gathered at the Commercial Cooking Council Meeting, who were exposed to this dramatic bit of "education"—this time by the customer instead of by the company—had a chance to learn a lesson at first hand that should help them tremendously in the sale of more commercial cooking loads during 1938.

"Capital Strike" Angers New Deal

By CARTER FIELD



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This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

GOVERNMENT policies have prevented the electric industry, for the last three years, from spending $1,000,000,000 a year on new construction, betterments, replacements, etc., according to reports made by the government's own officials to President Roosevelt. The figures were relayed to the White House through the Securities and Exchange Commission, which was concerned because it had expected to scrutinize a lot of new security issues which did not materialize.

Within a few days after this allegation had reached the White House the Edison Electric Institute was cited by the Committee of Utility Executives, in a formal statement, as estimating that a "construction deficit of $2,600,000,000 has accumulated in the past five years." It was added that the ten-year average of new construction by the utilities from 1923 to 1932 inclusive was $752,215,000 annually.

Regardless of which set of figures you choose—and there is very little discrepancy if proper allowance for different bases is made—it is obvious that one of the tremendous causes of the business recession which is creating so much worry in Brain Trust circles is the inability of the electric industry to do what it would normally have done—what it would beyond question have done had it not been for certain governmental policies.

Without knowing that the Administration's own figures would make the picture worse, the utilities executives say in their statement:

"Stemming from a fixed punitive policy toward the industry, a series of Administration measures have so frightened capital that it has proved impossible to finance most of the needed construction. While money rates have been low, the preponderance of the industry is unable to extricate itself, by refinancing, from the burden of pre-depression interest rates—at a continual loss of hundreds of millions to consumers and common-stock holders. All important 'equity money,' for common stock, the necessary protective 'cushion' to bonds and preferred stocks, has been frightened from the utility fields. It is being recognized that a policy of subsidized competition and strangulating regulation is in conflict with the policy of recovery."

Now the reaction of President Roosevelt to this type of argument is rather difficult for any business man to understand. He thinks he has made it abundantly clear that he is for continuance of private business, even in the electrical industry, wishing only to eliminate holding companies—save strictly investment trusts—in this field, and to cut profits down.

Whatever Mr. Roosevelt believes he believes firmly. It is like the law of the Medes and Persians, which changeth not. So he and his lieutenants look around for some other explanation of this "capital strike" in the electric industry. The explanation which they have seized upon, and which is now firm conviction, is that the utility corporations are holding back waiting for the decision of the Supreme Court on the constitutionality of the utility holding company death sentence.

The President has been strengthened in this belief by officials of the Securities and Exchange Commission. They have told him that the electric industry is waiting, because, once that decision is handed down, they will know how to proceed about new financing.

It is no secret that the very words "Supreme Court" irritate the President. So the mere suggestion to him by SEC that the utilities are holding back improvements—at a time when the business lag is giving him such concern—waiting for the high court to act, does not produce a frame of mind conducive to tolerant considering of any other factors there may be in the situation.

But this is only part of the picture. It will be recalled that the President virtually forced on Congress the idea of a tax on undistributed corporation earnings. Senate and House leaders opposed it violently. But now comes not only the SEC, but some of his most loyal Brain Trusters, with recommendations that something must be done for the little corporations which are unable to finance their needs.

Clinging to his original idea, the President is willing to modify the undistributed earnings tax sufficiently to exempt earnings paid out in stock dividends—*provided*—that the stock dividends are taxable as personal incomes. There was a five-to-four decision of the Supreme Court holding that a stock dividend is *not* income. But the court has changed a lot since then, might hold otherwise now.

But the corporation income tax is *not* going to be modified, if a presidential veto can stop it, so as to lift the double—sometimes triple—taxation of earnings which pass from an operating company to a holding company. Certainly not if the holding company is of the presidentially abhorred management type, as distinguished from a pure investment trust. So the President figures he will hit this particular target whether the Supreme Court sides with him or against him on the death sentence.

News OF THE WEEK

Municipal Ownership of Utilities Defeated by Voters at Elections

Proposals for cities to go into power business rejected by overwhelming majorities — Disfavor registered on bond plans — Pennsylvania county authority turned down — Virginia utility wins contract

Government ownership and operation of public utilities was given a setback last Tuesday in the general election when voters registered their overwhelming disapproval of every proposition which would have put the municipality in the power business.

While there were only a few contests, the results indicate a decided turn away from all measures which foster public ownership of utilities. The vote in each instance was of substantial proportions to conclude that the people are well satisfied with present private operations.

Reading against plant

Of major significance was the vote in Reading, Pa., where the electorate turned down by a vote of 17,366 to 10,014 the proposition to issue $4,750,000 for the purpose of constructing a municipally owned electric generating and distributing system. Public ownership advocates contended that the proposed city plant would pay for itself in fifteen years.

Reading is served by Metropolitan Edison Company, Associated Gas & Electric System unit, which is enlarging its facilities at a cost of approximately $3,000,000. The utility recently cut rates $795,000.

Pennsylvania voters in Pittsburgh, Allegheny County, were called upon to register their opinion on municipal utility ownership and the result was decidedly against. The proposal to set up a county public utility administration was defeated.

Proponents of the plan contended that such a group would provide a potential whip over utility rates. The wisdom of giving so much power to a board of three men was seriously questioned. The plan would permit the board to buy out utilities and operate them on a cost-of-service basis for the public.

Reject bond issue

In Beattyville, Ky., the voters turned down, 170 to 64, the proposition to issue $90,000 of bonds for the purpose of setting up municipal distribution facilities. In Irvine, Ky., the same proposition was decisively defeated. The city was to issue $275,000 of bonds. Both towns are served by Kentucky-Tennessee Light & Power Company, unit of the Associated Gas & Electric System.

By a margin of approximately two to one voters in Portsmouth, Va., approved the contract with Virginia Electric & Power Company which would result in a saving to the city of $20,000 a year. In lieu of the contract the city would go into the power business.

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Utility to Buy New Plants

Wisconsin Michigan Power Company, North American subsidiary, has entered into an agreement with the Northern Paper Mills Company, Green Bay, Wis., for the purchase of its Chalk Hill and White Rapids hydroelectric power plants on the Menominee River, according to R. E. Moody, vice-president of the utility. Mr. Moody said the sale involves $2,350,000 and is subject to the approval of the Wisconsin and Michigan public service commissions.

The plants have installed capacities of about 10,000 hp. each and will supplement existing power facilities of the utility in the Appleton vicinity.

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Chicago Utilities Quit Electric Association

Commonwealth Edison Company of Chicago and its associated companies, the Public Service Company of Northern Illinois, Illinois Northern Utilities Company and Western United Gas & Electric Company, have tendered their resignations as members of the Edison Electric Institute, according to statement of James Simpson, chairman.

"Being an integrated operating intrastate unit," Mr. Simpson said, "we are not concerned with many of the questions that are of vital import to a large number of members of the Institute and therefore we considered it good judgment to resign."

The resignation of the companies was sent to the Institute last July and acknowledged at that time. However, the formal announcement was not made until last week, after Mr. Simpson returned from a trip abroad.

The action of the Chicago utilities does not foreshadow other resignations, it was declared. In informed utility circles the resignation of the Chicago utilities was interpreted as a move to serve notice to the Federal Power Commission that they considered themselves as outside the jurisdiction of the federal agency.

The resignation marked the second since the Institute was formed in 1933, following the dissolution of the National Electric Light Association, the industry's former trade association.

Bonneville Rate Yardstick Held as No Standard of Power Costs

President Roosevelt approves formula proposed by Ross which will amortize project over 40-year period and return government 3½ per cent on investment — Taxes not considered in electric rates

Approval by President Roosevelt last week of the power rate formula developed by J. D. Ross, Bonneville administrator, to apply to government power projects was regarded as a significant step in the Administration's plan for an integrated federal power system.

The proposal to set a rate schedule which will enable the project to be amortized over a period of forty years and to return to the government 3½ per cent interest on its investment on that part of the project allocated to power was considered to be a forward step in recognizing costs inherent in the production of electricity.

Not a yardstick

However, utility managements point out that the proposed formula falls far short of being a "yardstick" for measuring costs and is inadequate. Mr. Ross said that he had not considered the question of tax payments in arranging the Bonneville rate. Utility officials pointed out that the provision for taxes constitutes a major item in computing electric rates. The utilities now pay from 15 to 20 per cent of gross revenues to governments in the form of taxes. This payment constitutes approximately 2.4 per cent of the total investment in properties.

Another item which eliminates the formula as a "yardstick," it is said, is the fact that the government is able to use the 3½ per cent interest rate because government borrowing constitutes a lien on all the property and earnings of the country, while the utilities, because they constitute private enterprise, must pay from 6 to 7 per cent, on the average, for their funds.

Another fundamental defect in the Bonneville formula, utility officials say, is the allocation of total investment of the project to power purposes. It was said that a juggling in this allocation will only reveal the extent of the subsidy which the taxpayers contribute to the government's program of cheap electricity for any particular section of the country. It was also pointed out that when a utility constructs a hydro project it must bear the entire cost, although benefits accrue to navigation, flood control and the like.

Commission allocates cost

Mr. Ross stated that when the Federal Power Commission makes a finding as to how much of the $51,000,000 which represents the cost of Bonneville is properly to be charged to power the rate schedule will be made.

"We ought to be businesslike about this thing and pay Uncle Sam back the money he puts up," Mr. Ross said.

The electricity being produced by the TVA could not be considered in a national scheme, Mr. Ross said, because the TVA is an experimental proposition and as yet has not contemplated any formula for fixing rates on the basis of a return to the government of the money it puts out.

It was also indicated by Mr. Ross that there might be a revision in the present 4 per cent rate on which Boulder Dam charges are based. This was seen in that Mr. Ross indicated that his formula could be made applicable to all government power projects.

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Four Members Named to Bonneville Board

The four-man advisory committee that will co-operate with J. D. Ross, newly appointed administrator of the Bonneville power development on the Columbia River, has been completed by the action of the various federal departments concerned. The members of the committee will act as liaison officers to keep the administrator in touch with plans of their respective agencies which may affect or be affected by the Bonneville development.

Representing the Department of the Interior will be Frank A. Banks, construction engineer of the Bureau of Reclamation in charge of the Grand Coulee development on the Columbia River, 200 miles above Bonneville. Mr. Banks has been with the Reclamation Bureau since 1906 and was formerly in charge of construction at the American Falls Dam in Idaho and the Owyhee Dam in Oregon.

The Department of Agriculture will be represented by Halbert Selby, agricultural economist, who has been connected with land utilization studies for the first AAA and the Resettlement Administration. He is at present in charge of land use planning for the states of Oregon, Washington and Idaho, with headquarters at Portland, Ore., under the Bureau of Agricultural Economics.

Col. Thomas M. Robins, division engineer for the Northern Pacific Division, Corps of Engineers, will act as representative of the War Department. Colonel Robins has long been identified with the development of the Columbia River region's water resources, his eight-year service at his present post covering the period of construction of the Bonneville project.

The Federal Power Commission will be represented by its chief engineer, Roger B. McWhorter.

•

Rise in Farm Income Favors Rural Service

Favorable conditions for the extension of rural service and for the sale of electrical appliances are indicated in the September issue of the *Guaranty Survey* of the Guaranty Trust Company of New York.

The sale of a larger aggregate output of farm products at a higher average price level is expected to bring the cash income of farmers this year to the highest figure since 1929, income from marketings alone is estimated by the Department of Agriculture at $8,575,000,000, and government payments are expected to raise the total to approximately $9,000,000,000, as against $7,865,000,000 last year.

"Although the estimated total for this year is about 14 per cent below that of $10,479,000,000 reported for 1929, the relative amount of purchasing power represented is considerably greater than this comparison would indicate because of the substantial net decline that has taken place in the general level of prices that farmers must pay," the survey

states. "With this factor taken into account, the Department of Agriculture calculates the total buying power of farm income this year will be equal to 103 per cent of the annual average for the period 1924-29, as against 96 in 1936, 70 in 1933 and 104 in 1929."

A prospective farm income with a purchasing power within 1 per cent of the 1929 figure and 3 per cent above the average for the few years immediately preceding the depression, together with sharp reductions in debt, interest charges and taxes, would seem to indicate that agricultural recovery has progressed to the point where the farm population can once more demand and consume its normal share of the country's industrial output," it was stated. "This situation is clearly one of the most important factors to be taken into consideration in appraising the outlook for general business in coming months."

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State Loses in Rate Cut Try

The attempt of the Pennsylvania Utilities Commission to impose a temporary reduced rate schedule on the Edison Light & Power Company of York, Pa., met with failure when the federal Circuit Court in Scranton delivered a two-to-one opinion against it. Commissioner Richard J. Beamish said the decision would be appealed to the Supreme Court of the United States.

Utility Construction Lag Traced to Government 'Punitive Policy'

Committee of Utility Executives declares "deficit" of $2,600,000,000 has accumulated in the last five years — Sees normal building expenditure of $1,000,000,000 in 1938 — Capital seen frightened by policy

The "fixed punitive policy" adopted by the Administration toward the utility industry was blamed this week by the Committee of Utility Executives for the electric utility construction "deficit" of $2,600,000,000 accumulated in the last five years. It was stated that this policy "has so frightened capital that it has proved impossible to finance most of the needed construction."

The committee cited the Federal Reserve Board's report that construction lags in the electric utilities and declared that this backlog of construction could be started "if present obstacles were removed." These were classified as "subsidized competition and strangulation regulation."

Pointing out that the ten-year average of new construction by the industry from 1923 to 1932, inclusive, was $752,215,000 annually, the committee stated that "next year's normal construction would justify an expenditure of at least $1,000,000,000."

Thus a vast untapped reservoir of jobs outrivaling the programs of PWA and WPA awaits release, the committee declared. "It is a privately financed recovery measure that will cost the taxpayers nothing and add billions to the taxable wealth of the nation."

It was declared that the annual average construction expenditures of the utilities over the last five years has been $238,961,000, including an estimated $450,000,000 for 1937, and the 1923-1932 average was $752,215,000.

"Thus, if the 1923-32 average is taken as representative of normal growth it is fair to say that the utilities have sustained a 67 per cent lag for five years."

Construction figures for the 1923-32 period were given as follows:

Year	*Expenditure*
1923	$794,000,000
1924	908,000,000
1925	846,000,000
1926	772,000,000
1927	794,000,000
1928	754,000,000
1929	853,000,000
1930	919,417,000
1931	596,740,000
1932	285,000,000
Total	$7,522,157,000

The figures for the last five years were as follows:

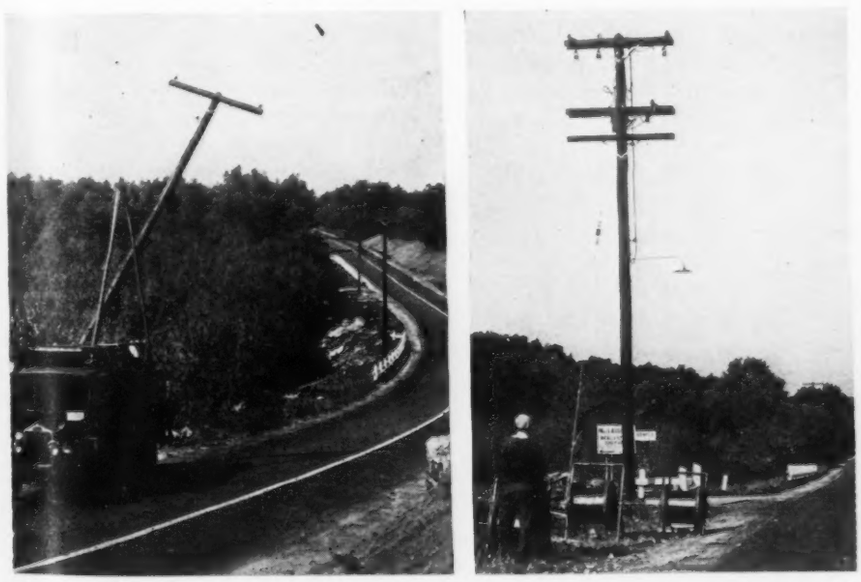
Year	*Expenditure*
1933	$129,300,000
1934	147,654,000
1935	192,855,000
1936	275,000,000
1937	(a) 450,000,000
Total	$1,194,809,000

(a) Edison Electric Institute estimate.

Noting that a gradual increase in construction expenditures has taken place since 1933, the committee declared that "it is apparent that the increase has notably failed to keep pace with the march of recovery in other fields. This is in the face of the fact that consumption of electricity in 1935 and 1936 successively exceeded all previous records."

Grapples with problem

The committee further held that "nor can responsibility for this condition be laid on the doorstep of utility management, whose personal interest depends on its solution and whose chief efforts for years have



LONG SPANS FOR BLACKSTONE VALLEY—New long-span rural construction job of Blackstone Valley (R. I.) Gas & Electric Company employs normal span of 375 ft. with 6A copperweld conductors and class 5 35-ft. S.P. poles, despite severe climatic conditions and unusual terrain. Spacing on this curve is 200 ft.

grappled with a problem beyond their control.

"Stemming from a fixed punitive policy toward the industry, a series of Administration measures have so frightened capital that it has proved impossible to finance most of the needed construction.

"While money rates have been low, the preponderance of the industry is unable to extricate itself, by refinancing, from the burden of pre-depression interest rates—at a continual loss of hundreds of millions to consumers and common-stock holders.

"All-important 'equity money' for common stock, the necessary protective 'cushion' to bonds and preferred stock, has been frightened from the utility field."

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Consolidated Edison Has New Radio Show

Primarily aimed at publicizing New York and at promoting the sale of electric, gas and steam products, including merchandise, "New York on Parade, Today and Tomorrow," current radio program of Consolidated Edison Company of New York, Inc., features a "World of Tomorrow" theme. Direction of the radio program, presented Monday nights over WEAF, is under Henry Obermeyer, Consolidated's vice-president in charge of advertising.

Technical research for the program, tying in with the widespread "tomorrow" interest generated by publicity for the 1939 World's Fair, is conducted by Dr. Orestes H. Caldwell, New York chairman of the American Institute of Electrical Engineers and former president of the New York Electrical Society.

The "commercials" are timed to emphasize current merchandising campaigns. In addition, the sponsor issues invitations to its customers and dealers to attend "Parade" broadcasts in N.B.C. Radio City studios. In November a start will be made on an invitation list of 25,000 apartment house owners in the company territory.

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Forty-Hour Week Adopted

Announcement has been made that the Mountain States Power Company has shortened the working week from 48 to 40 hours with no reduction in pay.

Murphy Elected Head of N.E.M.A. at Meeting

Four new projects are included in the N.E.M.A. new-business program for 1938, commercial wiring, commercial electric cooking, appliance sales manual and institutional safety. The 1938 program, which includes also activities in industrial relations, industry service, national and regulatory legislation, codes and standards, statistics and organization and management, was approved at the annual meeting last week in Chicago.

D. Hayes Murphy, Wiremold Company, was elected president and H. C. Petty, Crocker-Wheeler Electric Manufacturing Company, treasurer. The five vice-presidents are: F. W. Magin, Square D Company; Matthew Porosky, Gamewell Company; Walter Robbins, General Cable Corporation; C. E. Swartzbaugh, Swartzbaugh Manufacturing Company, and N. G. Symonds, Westinghouse Electric & Manufacturing Company.

The commercial cooking activities will be in co-operation with the newly organized Commercial Electric Cookery Council. Institutional safety promotion will be through the Bureau of Institutional Safety. Assistance will be given the National Retail Dry Goods Association in the preparation of an appliance sales manual. The possibilities of developing an adequate wiring promotional program for commercial buildings will be studied.

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Vermont Rural Electrification

Vermont utilities served 8,600 farm customers as of June 30, 1937, according to the state Public Service Commission. This classification includes those operating farms of three or more acres or yielding an annual income from agricultural production of more than $250. Rural construction by these utilities in 1936 totaled 321.4 miles as against 94.9 miles during 1935.

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FPC Expands Hearing on N. J. Merger Plan

The Federal Power Commission has enlarged the hearing scheduled for November 22 to include applications for approval of the mergers of three additional underlying companies of the Public Service Corporation of New Jersey into its chief subsidiary, Public Service Electric & Gas Company. The hearing was originally ordered to consider applications for the merger of six other Public Service Corporation affiliates into Public Service Electric & Gas.

The three new applications, all filed by Public Service Electric & Gas, seek approval of the mergers of Newark Consolidated Gas, Essex and Hudson Gas and Hudson County Gas into the applicant.

A total of $18,743,960 of the nine companies' $36,470,000 capital stock is owned by Public Service Electric & Gas and will not be replaced by new securities, the applications show.

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Rural Agreements Completed

Three rural electrification associations in the State of Washington have completed arrangements to buy power from private companies for distribution over lines to be built soon. The Cowlitz County Public Utility District will buy power from the Washington Gas & Electric Company, the Inland Empire Rural Electrification, Inc., from the Washington Water Power Company and the Benton County Rural Electrification Association from the Pacific Power & Light Company.

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Pay Small Service Fees

Wisconsin electric utilities controlled by holding companies had operating revenues of $44,163,390 in 1935 and paid $236,349, or one-half of 1 per cent, to their holding companies for supervision fees and special services, accoring to figures issued by the state Public Service Commission.

National Electrical Contractors Form Labor Relations Committee

Convention approves formation of group composed of one member from each district — Association membership to decide on policy — Pearl Peak is re-elected president — Patterson gets McGraw award

The National Electrical Contractors Association, at its recent convention in Los Angeles, went on record for the formation of committees to deal with the labor problems of the contractors. An amendment was passed creating a labor relations committee composed of one member from each district. The entire membership of the association is to decide on policy.

Explains plan

W. C. Mainwaring, general sales manager British Columbia Electric Railway, Ltd., outlined the policies which, for about six years, have made a working team of the contractors' association and the utility. Fundamentally, that policy has been recognition of the association as the business agency for the contract work which the utility has to do, the placing of all of its business through the association and the responsibility which the association has thus assumed to deliver the best and the lowest priced job for the utility.

It was pointed out by Mr. Mainwaring that misunderstandings have been cleared and that utility sales plans have been changed to give dealers equal opportunities. Range and water heater wiring is allocated to association members and complaints cleared through an industry committee. The association has worked out simplified practice of reduced wiring costs, provided sales training, advice to customers, organized promotion and other services. Price cutting is banished in open competition by establishing standards of practice and standards of conduct.

Thirty-three manufacturers, wholesalers and utilities exhibited in the "Electrical Exposition Extraordinary," which was run in conjunction with the convention.

Adequate wiring and the promotion of standards were emphasized by speakers. Co-operation was also stressed as furthering expansion of activities.

George W. Patterson of Toronto, Canada, was presented the James H. McGraw award and medal for electrical contractors.

Earl Peak of Marshalltown, Iowa, was unanimously re-elected president of the association, Ralph Walker of Atlanta, chairman of the N.E.C.A. distribution committee, was elected vice-president, to succeed Louis Kalisher of Brooklyn, who decided to retire from office.

D. B. Clayton of Birmingham, Ala., was elected to the executive committee for Division 5. E. C. Carlson of Youngstown, Division 4; H. C. Evans of Kansas City, Mo., Division 7, and Sam G. Hepler of Seattle, Division 10, were re-elected to the executive committee.

ELECTRICAL CONTRACTORS—Earl Peak, president of N.E.C.A., greeted at Los Angeles by Adolph Hoch, president of the Board of Public Works, at the recent convention. A. L. Stone and Glenn Arbogast are in the background

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New Holding Company Form Adopted by SEC

Adoption of a form designated as U-14-3 under the Public Utility Holding Company Act for the use of registered public utility holding companies in making annual reports to the SEC has been announced. Required information is based upon provisions of the uniform system of accounts for public utility holding companies adopted previously by the commission. The first report to be filed will cover the calendar year 1937 as to companies registered on January 1, 1937. As to companies registered after that date the first report will cover the portion of the year during which the uniform system of accounts was effective as to such companies.

The report form relates to the holding company as a legal entity separate from the holding company system of which it is a part, and therefore does not provide for consolidated statements of the holding company and its subsidiaries.

Reports shall be made on or before the first day of May in each calendar year for the preceding calendar year.

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Private Plant Changeovers

Three instances of changeover from private plants to central station service are reported by Consolidated Edison Company of New York, Inc., for August. These include: an office building, which has signed for 840 kw. to replace a 500-kw. steam electric generating plant; a refrigeration service, 310 kw. for a 240-hp. Diesel plant; an apartment house, 192 kw. for an 80-kw. Diesel plant. As reported in *Around the System*, annual revenue to the company is estimated at $57,000.

Many Major Federal Power Works Considered Economically Unsound

Prof. Riggs terms Grand Coulee Dam "America's grand mistake" and looks with doubt on worth of other government projects — Urges engineers to find facts and present them to public

Denouncing many of the federal government's major public works projects as economically unsound, Henry Earle Riggs, president-elect of the American Society of Civil Engineers and professor of civil engineering (retired) of the University of Michigan, called on the engineering profession last week to rally in behalf of the taxpayer.

Speaking at the annual dinner meeting of the Detroit-Ann Arbor section, American Institute of Electrical Engineers, Professor Riggs called the Grand Coulee Dam "America's grand mistake," referred to Passamaquoddy as a "weird scheme," and was less harsh in his condemnation of Fort Peck Dam, the Florida Ship Canal and the TVA.

Not utility advocate

"A duty rests on those engineers who are free to speak to find the facts regarding all of these and other projects and to present them truthfully and fairly to the non-technical public in non-technical language," Professor Riggs declared.

Charging the government with suppression of many official reports of engineering surveys pertaining to power, irrigation and navigation projects, Professor Riggs demanded that "all engineering reports on projects involving large expenditures of public money should be printed and made available to the public, and where action is taken which is not recommended, as in the case of Grand Coulee, there should be the most full statement of the reasons for the action."

He urged the "most rigid economy for the elimination of all unneeded projects of construction, for the avoidance of everything which will result in burdening the taxpayers with costly and unprofitable white elephants."

Going on record as not a utility advocate, Professor Riggs said that he was not opposed to public ownership of any municipal utility when such ownership can safeguard health or any other public interest, or can give better service or better rates than private ownership can do.

However, he said, "more than fifty years of experience with railroad and utility affairs have convinced me that government experimentation in business is not likely to be successful. No great and far flung enterprise can be wisely managed by a centralized bureau, with a large political board of directors such as a Congress, and with a personnel that is apt to reflect the individual political prejudices of the Administration, rather than knowledge and skill in the management of the particular business."

Discussing the tremendous losses which the government has incurred in its costly experiments in business, Professor Riggs declared that there has been no difference in municipally owned electric plants.

An analysis of the statistics of the electric industry as a whole show that municipal plants have about 4¼ per cent of the fixed capital in the industry, sell 5 per cent of the total kilowatt-hour output and receive something more than 6 per cent of the revenue, Professor Riggs stated.

Assail Federal projects

"On the basis of those figures," he said, "I cannot agree that they serve more cheaply than the privately owned plants. As long as those figures prevail, any propaganda to the effect that municipal ownership results in cheap rates is nothing but misstatement. And so long as some 1,500 out of a total of 1,800 such plants give no publicity to statistics of operation, I shall continue to claim that they do not dare give the actual figures to the public."

Concerning the Fort Peck Dam, Prof. Riggs said that it has practically no value for flood control. He labeled the Passamaquoddy tidal power project as a "weird scheme" and expressed the hope that it is finally dead.

Prof. Riggs saw no justification for Grand Coulee and pointed out that there is no present market for power from it or from Bonneville. He was critical of the accounting methods of TVA and pointed to the subsidies the taxpayers are contributing as part of its power rates.

•

Heavy Duty Scales to Be Installed at Plant

Six Richardson automatic coal scales with an individual capacity of 18 tons per hour and hopper capacity of 400 lb. have recently been shipped to the Williamsburg generating station of the Brooklyn & Manhattan Transit Company for weighing and recording the fuel supplied to six unit pulverizers serving two 600,000-lb.-per-hour Babcock & Wilcox boilers.

The scales were built to the specifications of the Stone & Webster Engineering Corporation, Boston, and are of heavy construction, weighing about 3,600 lb. each, with single beam design and continuously welded joints in the steel structures. Doors are lined with rubber seal to prevent escape of dust, and the scales are equipped to bypass coal in the event of power failure or other emergency. The guaranteed accuracy is within 0.5 per cent.

Eight similar scales of the same capacity are being installed in the Waterside station of the Consolidated Edison Company in New York and six scales of 500-lb. hopper capacity and a 30-ton per hr. rating have been installed this year at the State Line plant of the Chicago District Electric Generating Corporation, Hammond, Ind.

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Bids Asked for Work on Grand Coulee Dam

Bids have been asked for on December 10 for the completion of the high dam at Grand Coulee. Work on the present contract, covering the foundation for the high dam, will be completed by the end of the year and it is hoped to award the new contract in time to avoid any cessation.

The new contract will extend over a four-year period and will be one of the largest ever to be awarded by the government. It will include the mixing and placing of 5,800,000 cu.yd. of concrete, the placement of 79,000 tons of steel and 340,000 cu.yd. of excavation material.

of steel and 340,000 cu.yd. of excavation.

The contractor will be required to post a performance bond of $5,000,000 and an additional bond of $2,500,000 against default on labor and materials. Cement, steel and machinery purchases will not be included in the contract.

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Boston Edison Sales Show Sharp Increase

Heavy electric appliance sales by the Boston Edison Company gained substantially during the quarter just ended and energy sold, excluding interchange power, ran well above a year ago. In the former a gain of 10 per cent was registered over the third quarter of 1936 and the kilowatt-hour sales exceeded the former period by 7.8 per cent.

For the twelve-month period ended September 30 the company sold 980,256,313 kw.-hr., compared with 902,568,991 kw.-hr. a year ago, or an increase of 8.6 per cent. Thus the gain for the recent quarter was off but 0.8 per cent compared with the gain for twelve months, emphasizing the value of utility service under fluctuating economic conditions to "all sorts and conditions of men."

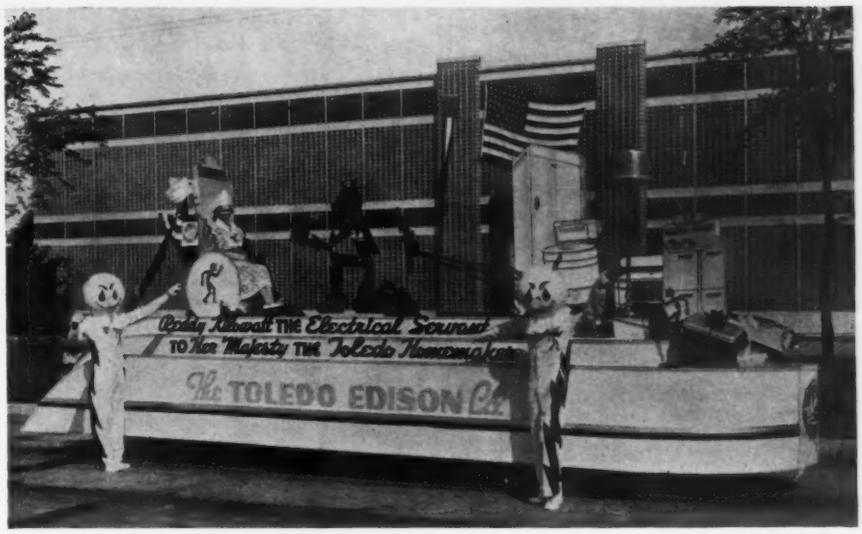
More than 1,800 electric ranges, water heaters and refrigerators were added to the lines in the recent quarter, and for the first nine months of this year company sales of electric refrigerators totaled 4,076, a 25 per cent gain over last year's comparable period. Vigorous activity in electric range sales is evidenced by a nine-month company sale of 1,500, a 47 per cent increase, and water heaters jumped 36 per cent.

President Frank D. Comerford pointed out that while gross revenues improved 6 per cent in the recent quarter, tax accruals increased 9 per cent, other operating costs such as wages, fuel and materials rising 8 per cent. A $440,000 gain in business volume was distanced by $490,000 in higher expenses.

•

North Dakota Rural Lines

The Board of Railroad Commissioners of North Dakota reports approximately 450 miles of rural line with 563 customers, out of a total of 4,000 miles of transmission lines serving the state.



ELECTRICAL SERVANT—Prize-winning float of Toledo Edison Company featured in the Toledo Centennial parade with Miss Doris Williams as "Her Majesty the Toledo Homemaker," with domestic representatives Harry Herman and V. F. Mueller representing "Reddy Kilowatt"

Cape Cod Tie Planned to Increase Capacity

Improvements in the Cape & Vineyard Electric Company's system extending from the Cape Cod Canal to Hyannis and from Orleans to Provincetown, Mass., are in early prospect if the financing plans are approved by the Massachusetts commission.

The betterments are designed to provide increased transmission line and substation capacity and to insure greater reliability of service. They include, with estimated costs: (1) A new span over the Cape Cod Canal at Bourne, with two 200-ft. steel towers, aluminum steel reinforced conductors, insulators and fittings for a 2,000-ft. maximum stretch, $32,500; (2) 17 miles of 110-kv. wooden H-frame line, with No. 4-0 aluminum steel reinforced conductor, 12-ft. spacing, and two ground wires from the Canal to Hyannis, $240,000; (3) a 12,000-kva. substation at Hyannis with tertiary transformer windings of 35 per cent of the capacity to meet local requirements and four 500,000-kva. rupturing capacity circuit breakers, $130,000; (4) a 28-mile, 44-kv. line from Orleans to Provincetown, with reclosing breaker at Orleans, $140,000; (5) substation, 1,500 kva., at the generating plant of the Provincetown Light & Power Company, $16,500.

These outlays will tie the steam plant of the New Bedford Gas & Edison Light Company with the Provincetown company's 1,260-hp., four-unit Diesel-electric station near the "tip of the Cape." They will provide capacity for increasing loads in certain areas previously dependent on circuits of low capacity and high exposure to severe weather conditions. The Provincetown company was recently acquired by the New England Gas & Electric Association, Cambridge, which operates the New Bedford and Cape & Vineyard utilities, as well as others in eastern Massachusetts and New Hampshire.

•

Fixes Municipal System Cost

Construction of a municipal electric distribution system for Columbus, Neb., would cost $238,530, Robert Fulton, engineer, estimated in a deposition in the District Court trial at Columbus testing validity of a $250,000 bond issue for constructing a municipal system. Mr. Fulton estimated it would cost an additional $10,600 for a transmission line to the Columbus power house of the Loup River public power district, from which the city proposes to buy electricity.

•

Power Plant for Ohio School

A power plant, to cost $200,000, and to furnish heat and electricity for the eighteen buildings on the campus, will be built before next September by Wooster College (Ohio), according to Charles F. Wishart, college president.

Man-Power Discussed With Tool Builders

In an address at the meeting of the National Machine Tool Builders Association held at Hot Springs, Va., October 25-27, A. C. Danekind, chairman of the General Electric Company's committee on factory equipment and practice, stressed the changing relationship between man-power and machine tools.

"The new conceptions of men as to their privileges and their responsibilities, which have been a concomitant of the New Deal in Washington, is the biggest single problem in management today," Mr. Danekind stated. "A true inventory of man-power will reveal new and radically different man-attitudes as compared to those of but a few years ago. Management is generally committed to the philosophy of producing a better quality of product at reduced costs, and by so doing it hopes to broaden a given market and thus enjoy an increased volume of business. In other words, more goods, for more people, for less money. To do this means that every advantage must be taken of machine tools which will transfer an ever-increasing portion of human skill from the job."

•

Middle West Elects Kruesi to New Executive Position

F. E. Kruesi, vice-president of the Middle West Service Company, has been elected to the new office of executive vice-president. He will be in charge of the company's operations.

Directors of the Middle West Service Company and the Middle West Corporation have accepted D. C. Green's resignation as president and director of both companies, effective at once, rather than on December 1, as originally contemplated.

Resignation of E. A. Olsen as a director of the Middle West Corporation and as vice-president and director of Middle West Service also was accepted.

•

Section Chairmen Nominated

Earl Prain, Wisconsin Public Service Corporation, has been nominated as chairman of the commercial division of the electric section of the Wisconsin Utilities Association, which meets November 11 and 12 at the Pfister Hotel, Milwaukee. H. Turkelson, Wisconsin Gas & Electric Company, Racine, has been nominated as vice-chairman.

The technical division of the section has nominated E. H. Cotton, Northern States Power Company, as chairman, and H. H. Brown, Wisconsin Michigan Power Company, as vice-chairman.

•

Edison General Electric Meet

Edison General Electric Appliance Company, Inc., will hold its first annual "Hotpoint Partners'" meeting at the Edgewater Gulf Hotel, Edgewater Park, Miss., on November 8-11, according to R. W. Turnbull, vice-president. The expansion program of the company will be announced to the executive heads of the distributing organization at the meeting.

•

Defers Dividend Payment

On September 2 directors of the General Public Service Corporation declared dividends of $1.50 on the $6 preferred and $1.37½ on the $5.50 preferred, payable November 1 to stock of record October 15. "At recent low prices of securities," the company states, "there was under the Delaware law an impairment of the capital represented by the preferred stock. In view of this circumstance, directors at the meeting October 28 deemed it prudent to postpone payment of those dividends . . ."

Meetings

Wisconsin Utilities Association—Electrical section, commercial and technical divisions, convention and exhibit. Pfister Hotel, Milwaukee, Wis., November 11-13. A. F. Herwig, executive secretary, 135 West Wells St., Milwaukee, Wis.

American Society of Mechanical Engineers—Annual meeting, New York, N. Y., December 6-10. C. E. Davies, national secretary, 33 West 39th Street, New York, N. Y.

American Engineering Council—Annual meeting, Mayflower Hotel, Washington, D. C., January 13-15. Frederick M. Feiker, executive secretary, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 24-28. H. H. Henline, national secretary, 33 West 39th Street, New York, N. Y.

Kitchen Modernizing Reported by Utilities

A total of 25,647 electric kitchens were added to the lines of twenty-three utilities in the twelve months ended August 1, 1937, according to the National Kitchen Modernizing Bureau. Of these, 9,683 included the sale of an electric refrigerator, range and water heater and 15,784 the sale of an electric refrigerator and range; total sales exceeded $5,000,000.

The bureau reports that utilities have found the kitchen modernizing approach of value in selling individual pieces of kitchen electrical equipment. Thus Associated Gas & Electric Company, using a similar ensemble plan, reported the sale of 31,303 electric refrigerators, 5,780 electric ranges and 2,434 electric water heaters between January 1 and May 1 this year.

Alabama Power Company installed 62 all-electric kitchens, but individual sales of major appliances for the company during the same period totaled 18,500 refrigerators, 5,700 ranges and 3,000 water heaters. Total sales in the Georgia Power Company's territory for the first six months of 1937 (dealer and company sales) were 16,000 refrigerators, 3,700 ranges and 2,250 water heaters. Oklahoma Gas & Electric reported 9,812 refrigerators added to its lines during the year and Public Service Company of Oklahoma during the same period added five all-electric kitchens, 6,325 refrigerators, 222 ranges and 22 water heaters.

Local modernizing bureaus now total 155, cover 40 states and the District of Columbia, the bureau states, an increase in number of 182 per cent (100 bureaus) being reported for the year ended August 1, 1937.

•

Hydro Loses for Fifth Year

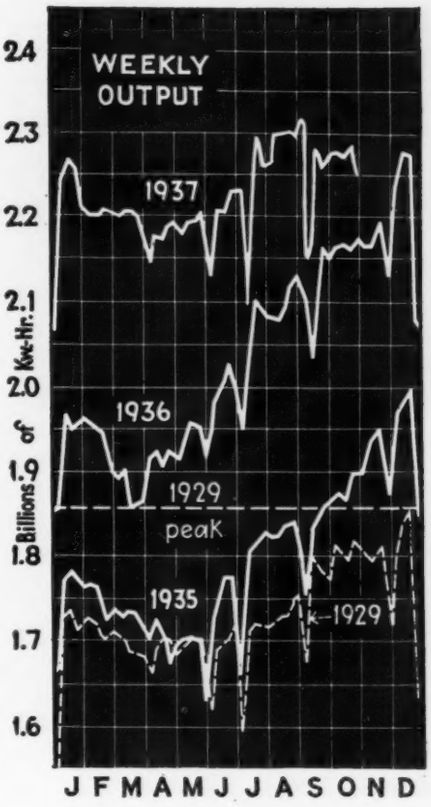
Crisp County's (Georgia) hydro-electric plant, constructed on the Flint River in 1931 at a cost of approximately $1,345,000, is still "in the red" after its fifth year of operation. Reports to the Federal Power Commission place its deficit for 1936 at $19,463, as against a deficit of $38,673 for 1935 and of $49,082 for 1933. County has asked the commission for exemption from the annual charge of $1,000 made by that body for the right to operate a power plant.

Energy Output Declines

Production 4.1% over 1936, but drops 1.2% under preceding week, against normal trend

With an output of 2,254,947,000 kw.-hr. during the week ended October 30, the operations of the electric light and power industry fell off about 27,000,000 kw.-hr., or 1.2 per cent, compared with the preceding week, while maintaining a lead of 4.1 per cent over the like week a year ago, according to figures announced by the Edison Electric Institute.

This brings the production approximately to the level of the latter part of July and below that of any succeeding week except the one including Labor Day. The movement was contrary to the normal rising trend at this season of the year. The sharpest decline was registered in New England, where production fell under the preceding year's figure for the first time since April, 1935. In contrast there was a gain of 9.2 per cent on the Pacific coast, exceeded only twice in that area since last February. Elsewhere the increase ranged from 2.5 per cent in the West Central to 4.1 per cent in the Middle Atlantic states.



Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
Oct. 30...2,255	Oct. 24..2,167	Oct. 26..1,896
Oct. 23...2,282	Oct. 17..2,170	Oct. 19..1,863
Oct. 16...2,276	Oct. 10..2,168	Oct. 12..1,867
Oct. 9...2,280	Oct. 3..2,169	Oct. 5..1,863
Oct. 2...2,276	Sept. 26..2,157	Sept. 28..1,857
Sept. 25...2,266	Sept. 19..2,171	Sept. 21..1,852

Per Cent Change from Previous Year

Region	Week Ending Oct. 30	Oct. 23	Oct. 16
New England.....	+ 2.0	+ 0.7	+ 1.1
Middle Atlantic.....	+ 4.1	+ 6.3	+ 4.8
Central Industrial...	+ 3.2	+ 6.3	+ 6.6
West Central.....	+ 2.5	+ 2.1	+ 5.8
Southern States.....	+ 3.4	+ 4.0	+ 6.8
Rocky Mountain....	+ 3.8	+ 7.0	+ 6.7
Pacific.....	+ 9.2	+11.0	+ 4.6
United States.....	+ 4.1	+ 5.1	+ 5.0

Westinghouse Enters Home Air Unit Field

Offering complete residential air conditioning for both summer and winter as a packaged unit, Westinghouse Electric & Manufacturing Company is entering the home air conditioning market, according to P. Y. Danley, manager of the refrigeration and air conditioning department.

According to the announcement, Westinghouse will concentrate on the market consisting of new homes costing $5,000 and more. Distribution activities will be handled from the headquarters of the merchandising division at Mansfield, Ohio; distribution will be through franchised dealers.

The new unit consists of a central system of matched units, including a gas- or oil-fired warm air furnace, with filters, blower and humidifier for winter use, and with the "Seal-less" condensing unit and cooling coil for summer air conditioning.

•

Output Maintains Advances

Consumption of electric power in Texas during September continued the wide margin of gain over last year which has prevailed during the past several months, the University of Texas Bureau of Business Research has announced.

Reports from seventeen electric power companies of the state give total production of 238,000,000 kw.-hr. during the month, an increase of 19.3 per cent over September, 1936. For the third quarter production totaled 703,000,000 kw.-hr., an increase of 20.8 per cent over the similar period last year.

Power Application Denied

Federal Power Commission has denied an application by the Gasconade River Power Company of Kansas City, Mo., for a license to build a hydroelectric development on the river in Phelps and Pulaski counties, Mo.

The commission in its opinion asserted the company was responsible for delaying development of the power site since 1928, and contended further that the financing plan outlined in the application was undesirable. The decision does not mean that the company will relinquish the project, Ralph W. Street, president, stated.

•

Defers $8,000,000 Issues

St. Joseph Railway, Light, Heat & Power Company has deferred offering of $6,000,000 of 4 per cent bonds and $2,000,000 of serial notes.

The company intended placing the new bonds on the market to meet the payment of principal and interest on $5,000,000 of first mortgage 5 per cent bonds due this week. A group of New York banks has made available to the company funds with which to meet this obligation. In view of existing market conditions, the incurring of bank loans was considered the better procedure.

•

Anaconda Cuts Output, Wages

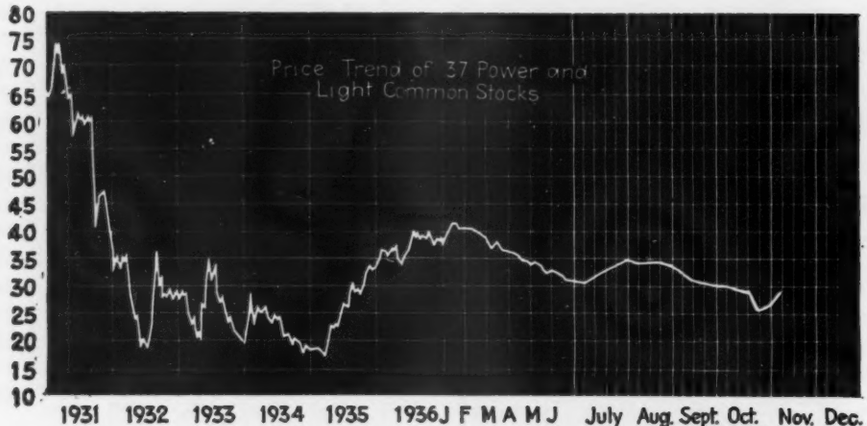
Declining wages for Anaconda Copper Mining Company employees (the result of a sliding wage scale based upon selling price of copper) is accompanied by announcement of production curtailment. The Tramway mine of Anaconda closed with the night shift on October 28, affecting approximately 900 men. Curtailment was made necessary, it was learned, because of recession in demand for copper and copper products.

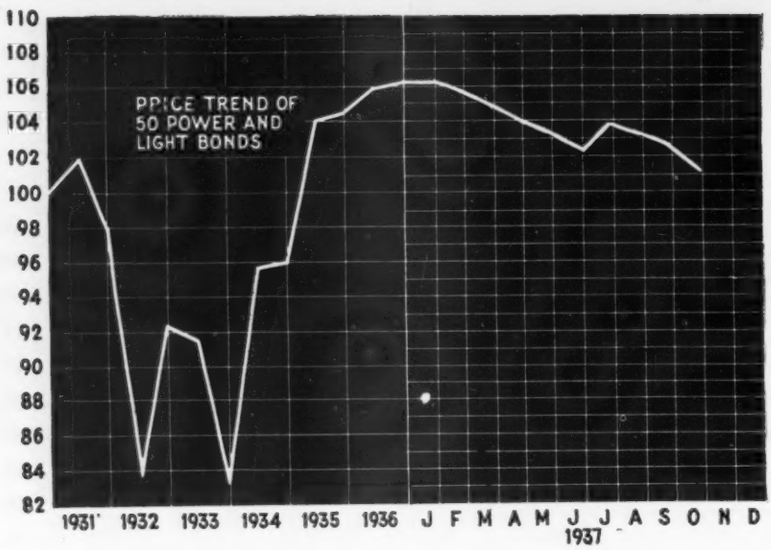
•

Reconnection Charge Set

Announcement has been made by the Des Moines Electric Light Company and the Des Moines Gas Company of a change in policy in regard to service connections after the service has been discontinued for non-payment of bills. A charge of $1 will be made for all such reconnections in order to be fair to customers who pay their bills promptly and to avoid discrimination.

Stocks Continue Gains; Bonds Stronger





Utility stocks continued in their upward trend, "Electrical World" index rising to 28.6; previous week, 26.5; year ago, 38.4; 1937 high, 41.5. Bond index was below last month's mark, but prices were above the low set during the middle of October. "Electrical World" index, 100.9; previous month, 101.9; year ago, 106.0; 1937 high, 106.2

Trustee Appointed; Atlas Plan Opposed

Federal Judge Holly has entered an order appointing Willoughby G. Walling as temporary trustee of the Utilities Power & Light Corporation. The Atlas Corporation, of which Floyd B. Odlum of New York is president, and which owns about $25,000,000 of the corporation's debentures, fought the appointment of Mr. Walling when on August 14 Judge Holly named him permanent trustee. Mr. Odlum has announced that he has withdrawn his opposition. It is expected that Mr. Walling's appointment will be made permanent.

Vigorous opposition has developed in federal court to the plan of reorganization for Utilities Power & Light proposed by Mr. Odlum. Attorneys for the Associated Investing Corporation, a unit of the Associated Gas & Electric System, announced that they would fight the plan.

•

$71,000,000 Suit Settled

Federal Judge James H. Wilkerson of Chicago has approved a settlement whereby ten banks in that city and New York and the General Electric Company will turn over $4,636,088 for the benefit of holders of debentures and notes, respectively, of Insull Utility Investments, Inc., and the Corporation Securities Company, the two defunct Insull investment companies.

In return for this settlement, including an agreement by the banks to withdraw claims against the two companies aggregating $71,000 000, the trustees in bankruptcy for the two companies and attorneys for the debenture holders have agreed to the dismissal of more than a score of suits, both in Chicago and New York, against the banks and General Electric.

•

North Boston Utility Offers 10-Year Notes

Public offering of $13,000,000 of 3½ per cent 10-year secured notes of North Boston Lighting Properties was made last week at par and immediately the notes went to a premium.

Proceeds of the issue will be used primarily to repay bank loans and to finance additions and improvements over the past few years to electric and gas properties. The offering represented one of the few recent examples of financing by a holding company for its operating units. Upon completion of the financing the subsidiaries will have no bonds, preferred stock or notes with the public, and will be entirely free of mortgage debt.

Out of the proceeds an advance of $674,375 is to be made to Haverhill Electric Company, a subsidiary, to redeem on December 1 its outstanding first mortgage 5 per cent bonds due 1942.

•

Edison Hearing Postponed

At the request of Consolidated Edison Company of New York, Milo R. Maltbie, chairman of the New York Public Service Commission, has postponed the hearing on the application of the company to issue $30,000,000 debentures for capital purposes.

Earnings Reports (Utilities)

	Net Income 1937	1936
*Cons. Edison N. Y. and affil.	$35,535,067	$36,097,532
*Pub. Serv. N. J. and subs.	8,696,755	6,742,744
†*Assoc. G. & E. and subs.	34,828,011	35,905,609
*Comm. & South. and subs.	15,996,841	11,700,037
*North Amer. and subs.	19,419,397	15,534,833
*Natl. Pwr. & Lt. and subs.	8,696,755	6,742,744
*Boston Edison	5,468,252	5,126,963
*Consumers Power	10,204,262	8,361,420
*Alabama Power	4,012,474	3,373,544
*Georgia Power	5,097,099	4,836,642
*Wash. Water Pwr. and subs.	2,750,666	2,697,976
*Texas Pwr. & Light	2,143,906	2,330,818
*Montana Pwr. and subs.	3,737,140	2,886,148

*Twelve months ended September 30.
†Operating income (preliminary).

Three 100-kva G-E Pyranol transformers installed at the plant of the Eli Lilly Co., Indianapolis, Ind.

Again

PYRANOL TRANSFORMERS SHOW SUBSTANTIAL SAVINGS IN INDOOR INSTALLATION

THE Eli Lilly Company of Indianapolis, manufacturing chemists, made a substantial saving in total installed transformer cost when it ordered G-E Pyranol transformers for this 'new installation. Short runs of secondary cable were desired, and Pyranol transformers could be installed at the load center without the expense of heavy vault construction. Installation of oil-filled transformers outdoors to save vault-construction expense would have entailed long secondary cable runs and would have marred the attractive appearance of the plant. This installation was made in the basement — the noninflammable, nonexplosive Pyranol transformers affording a high degree of safety. • It will pay you to use Pyranol transformers for your plant — particularly if you are considering a new indoor installation. Recognition of Pyranol by the National Electrical Code permits their installation indoors with many of the restrictions applying to oil-filled transformers removed. More than 300,000 kva of these transformers are installed—many having been operating more than five years—all giving excellent service. For complete information write the nearest G-E sales office, or General Electric Company, Dept. 6 -201, Schenectady, N. Y. Ask for Bulletin GEA-2048.

300-51

GENERAL ELECTRIC

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Recording and Using Line Troubles Data

By P. N. KENT
Kansas City Power & Light Company
Kansas City, Mo.*

Data from the daily records of line troubles kept by the overhead systems department of the Kansas City Power & Light Company are entered in a summary record which is totaled up at the end of the year, and it is from this that material and circuit performance data are obtained. Here is a sample of the summary report, the record of a typical 33,000-volt circuit:

	1935	1936
Relays and reclosures without time outage:		
Lightning disturbances...	17-68%	8-47%
Wind storm — dancing conductors.....	0	5-29.5%
Substation trouble (company).....	1- 4%	0
Floating conductors.....	1- 4%	0
Substation trouble (customer).....	1- 4%	0
Sub-totals.....	20-80%	13-76.5%
Relays and lockouts with time outage:		
Lightning disturbances...	2- 8%	2-11.7%
Wind storm—Conductors burned down.....	0	1- 5.9%
Substation transformer burned up.....	1- 4%	0
Conductor pulled in two..	0	1- 5.9%
Crane into line — Conductor burned.....	1- 4%	0
Sub-totals.....	4-16%	4-23.5%
Circuit opened manually, account of trouble at station	1- 4%	0
Totals.....	25-100%	17-100%

It is to be seen from the above partial analysis that by far the largest percentage of interruptions are caused by lightning disturbances. This analysis could be carried out in much more detail by means of the available data in the daily records, which would give the material and line locations which received the main effects and damages, if any, from the disturbances. This same sort of summary can be made for all the overhead distribution and transmission circuits, and for any single year, or as a composite summary of a number of years.

* Fourth installment of a series from paper to Missouri Valley Electric Association.

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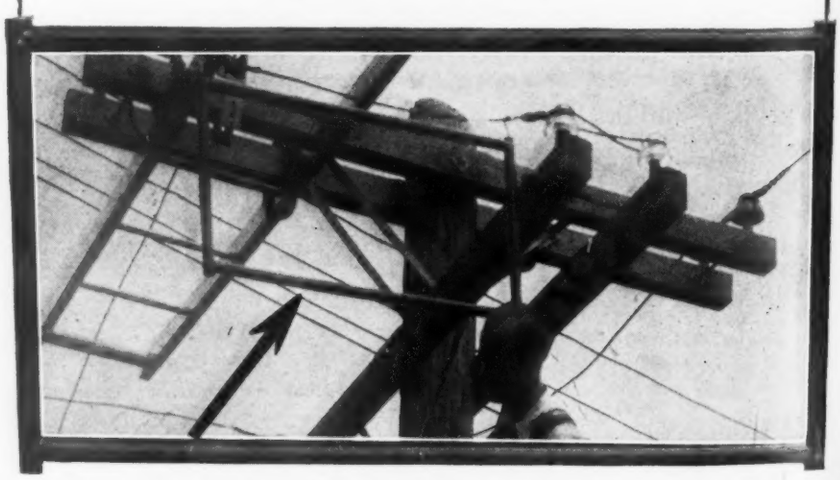
Warning Device for Linemen

Inadvertent contact with a hot conductor by a lineman working on a pole is guarded against on the overhead system of the Oklahoma Gas & Electric Company by the use of the warning device here illustrated. The device consists of a rectangular frame made of micarta tubing or rod, doweled with wooden pins and equipped with two open end hooks by which the frame is hung on the live conductor. The dimensions are approximately 35x19¾ in. The lineman working below is continually warned by the presence of the frame that there is a hot wire above his head.

Micarta frame protects lineman



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Difficulties in Co-ordinated Fusing

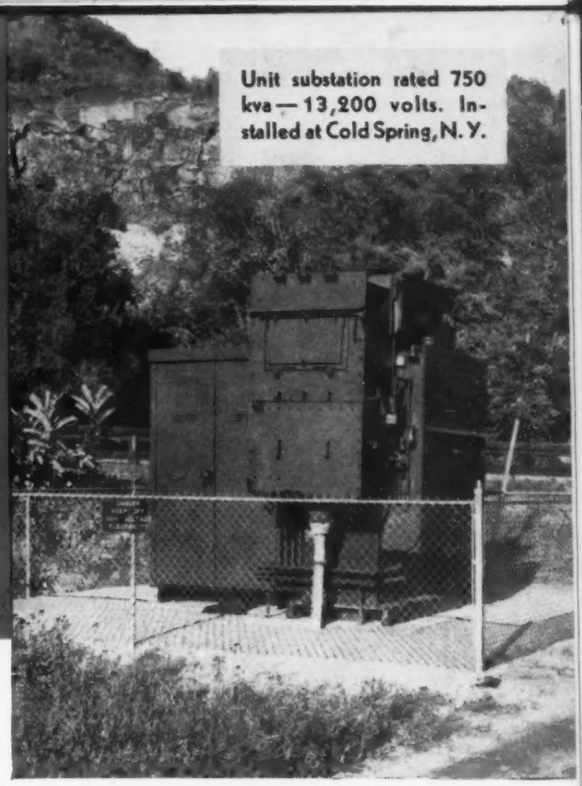
By JOHN I. HOLBECK
Relay Engineer Minnesota Power & Light Company, Duluth, Minn.

Such is the variety of fuses with varying characteristics available on the market that it has become increasingly difficult for the operating engineer to decide on what he should use. Of course, each utility can standardize by selecting the products of one manufacturer, but even then it will be found that a manufacturer may be making as many as seven types of links with different characteristics for a given line of cutouts.

Not only is there a variety of fuse links to choose from, but there are

SAVE

WITH UNIT SUBSTATIONS



Unit substation rated 750 kva—13,200 volts. Installed at Cold Spring, N. Y.

SAVE system investment—real estate—taxes—layout time—and reduce construction and installation time. Here are a few G-E unit substation installations where these savings have been obtained. Your system, too, may present similar opportunities. General Electric Company, Schenectady, N. Y.

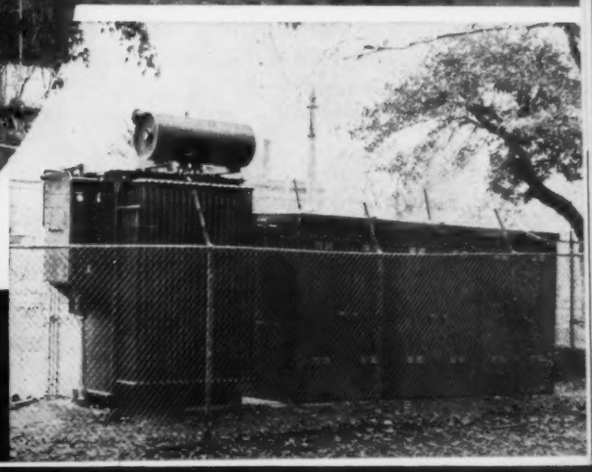
Below Right—
Two unit substations, each rated 750 kva—23,900 volts. Installed at El Paso, Texas.

Center Right—
Unit substation rated 1500/2000 kva—33,000 volts. Installed at Indianapolis, Ind.

Lower Right—
Unit substation rated 1500 kva—11,000 volts. Installed at Rochester, N. Y.

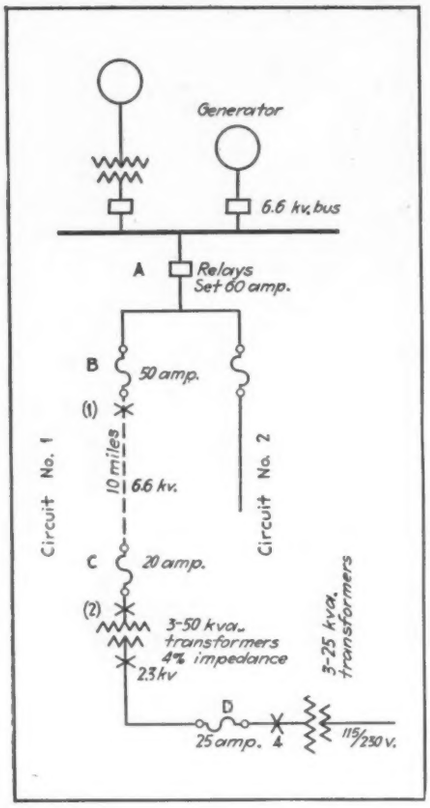
Unit substation rated 1500 kva—13,800 volts. Installed at Aurora, Ill.

Unit substation rated 1500 kva—13,800 volts. Installed at Louisville, Kentucky.



GENERAL ELECTRIC

310-25



How fuse co-ordination can go haywire

also different methods of current rating in use. This adds to the confusion. In the past most of the fuse links had a 65 per cent rating; that is, the load current should not exceed 65 per cent of the current rating to prevent the temperature rise from exceeding 30 deg. C. above an ambient temperature of 40 deg. C. for the conducting parts. Most of the newer fuses have the 100 per cent rating and will carry 100 per cent of rated current continuously without exceeding a temperature rise of 30 deg. C. above an ambient temperature of 40 deg. C. external to the cutout. This merely means that a fuse link formerly rated 150 amp. is now rated 100 amp. The logical thing to do is to concentrate on the links of the new rating and gradually eliminate the old type fuse links.

The detailed recital given in the accompanying illustration of what very easily may happen on a given circuit in the present confustion of fuse ratings and characteristics discloses the urgent need for early agreement among manufacturers and utility engineers on requirements of fuse performance and on standardization of statements of characteristics designed for these requirements.

As a specific example, consider the 6.6-kv. feeder of circuit No. 1 in this diagram is protected with induction relays and an oil circuit breaker at the supply station. Point "C" is approximately 10 miles beyond point "B." Point "D" is located ¼ mile beyond point "C." It is proposed to use standard fuse cutouts of only one manufacture at points "B," "C" and "D." Assume that each three-phase transformer bank must carry as much as 30 per cent overload for several hours each day. It is desired to fuse the transformers on the high-voltage side for overload and short-circuit protection.

At D, 25 amp., 100 per cent rated, fast-blowing, cable-type fuse links are logically selected for the 2.3-kv. cutouts. At C, 20 amp., 100 per cent rated, fast-blowing cable type fuse links are used to meet the 30 per cent overload current of 17 amp.

Now, three-phase short circuit (4) at point "D" is equivalent to 948 kva. or 238 r.m.s. symmetrical amperes at 2.3 kv. and 83 amp. at 6.6 kv. The 25-amp. fuse links at point "D" will blow in 0.09 second, while the 20-amp. fuse links at point "C" will delay for 0.40 second before blowing. At point "C" it is desired to have fuse links whose melting time is at least ¼ second longer than the blowing time of the fuses at point "D." The melting time of the fuses at point "C" for short circuit (4) is actually 0.33 second, or 0.24 second longer than the blowing time of the fuses at point "D."

For short circuit (2) 301 amp. will flow through the 20-amp. fuses at point C and cause them to blow after a delay of 0.03 second. The melting time of the fuses at point "B" should then be about 0.28 second for short circuit (2). By using 50-amp., 100 per cent rated fuse links at point "B" their blowing time will be 0.38 second for short circuit (2). For short circuit (1) the 50-amp. fuses at point "B" will blow in 0.08 second at 642 amp. The induction relays at point "A" are set to operate at the equivalent of 60 amp. at 6.6 kv. For short circuit (1) these relays will close their contacts after a time delay of 0.66 second. Thus there is co-ordinated action all down the line.

Suppose, however, that a short circuit develops at point "D," short circuit (4), and the fuse links at "D" are blown. The utility has two types of fuse links in stock because at first it standardized on the universal low

[*Continued on page 102*]

Hammer Off the Insulation

Junking copper wire and cable by burning off the insulation is common practice in electric utility salvage operations. But aluminum cable cannot be subjected to such treatment because the metal would be injured by the high temperature. So they tried a different way to remove insulation from aluminum cables in the warehouse of the Union Electric Light & Power Company, St. Louis, Mo. They hammer it off. In a frame of heavy timbers is mounted a small air hammer, its downward operating head just above a heavy block of steel. The cable is fed across the top of the block and pounded by the hammer as it moves along.

This treatment crushes and detaches the branded insulation, which then falls to the floor as the cable emerges from the machine.

Air hammer cuts insulation off

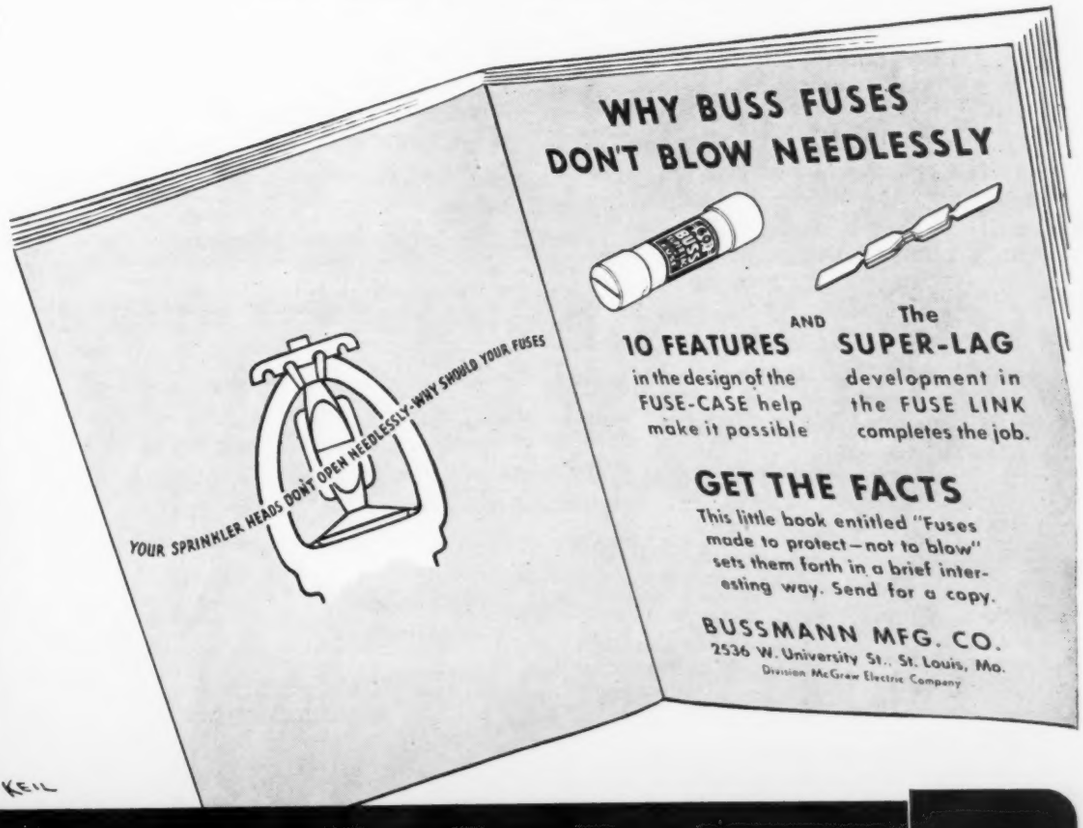
HERE'S THE STORY... Says

Mr. R. MONROE, Chief Electrician of American Brake Shoe and Foundry Co., Mahwah, N. J.

"Prior to June 29th, 1933 we experienced great trouble in getting ordinary 60 ampere 250 volt renewable fuses to hold the starting load of one of our grinders. These fuses blew about twice a week.

On June 29th, 1933 we installed BUSS Super-Lag Fuses then stood by and started the grinder up 10 times without one blow.

On January 8th, 1934 we checked this installation and found the same fuses still in service. Checked again on January 27th, 1936 and found no blows to date."


YOUR SPRINKLER HEADS DON'T OPEN NEEDLESSLY-WHY SHOULD YOUR FUSES
WHY BUSS FUSES DON'T BLOW NEEDLESSLY
10 FEATURES AND The SUPER-LAG
in the design of the FUSE-CASE help make it possible
development in the FUSE LINK completes the job.
GET THE FACTS
This little book entitled "Fuses made to protect—not to blow" sets them forth in a brief interesting way. Send for a copy.
BUSSMANN MFG. CO.
2536 W. University St., St. Louis, Mo.
Division McGraw Electric Company
KEIL

Lag FUSES

temperature 65 per cent rated fuse links and later on concentrated on the fast-blowing universal cable type 100 per cent rated links when they came on the market. Both types of links are made by the same manufacturer. By mistake the trouble shooter replaces the blown fuse links with 25-amp. 65 per cent rated links which will blow in 0.36 second for short circuit (4). As the melting time of the 100 per cent rated 20-amp. fuse links at "C" is only 0.33 second for short circuit (4), they will blow along with the 65 per cent rated links installed by mistake at point "D." Similarly, if 65 per cent rated fuse links should be installed at "C" they will blow in 0.12 second for short circuit (2) and the 100 per cent rated links at "B" will melt in 0.27 second, leaving very little leeway between the two sets of fuses.

In replacing the 50-amp., 100 per cent rated fuse links at "B" with 50-amp., 65 per cent rated links the co-ordination with the relays at "A" is disturbed, because then the fuses at "B" will blow in 0.80 second and the relays at "A" will operate in 0.75 second for a short circuit near point "C." The fuses at "B" protect 10 miles of line between points "B" and "C." For short circuit (1) the fuses would blow after 0.28 second and the relays would have a time delay of 0.66 second, which of course would work out satisfactorily.

Department Routine in Meter Standardizing

By HARRY G. HAMMOND
Meter Standards Laboratory, Detroit Edison Company, Detroit, Mich.

Instrument accuracy in the meter standards laboratory of the Detroit Edison Company is based upon the work of the U. S. Bureau of Standards and on government standard time. The accompanying chart shows how these two basic standards are directly tied to the primary standards in the laboratory and through the latter the working instruments. In addition, the chart shows a considerable amount of routine cross-checking which furnishes a continuous indication of accuracy among these instruments.

All checks are made at a sufficient number of scale points on each instrument to bring out its accuracy characteristic curve. The standardization schedule is intended to apply only when instruments are in good commercial accuracy, and a more detailed check and thorough investigation than is prescribed in the schedule is given whenever the performance of an instrument is inconsistent. A check of the zero reading of the instrument is made in all cases before making any tests and is as carefully recorded as the readings on any other point of the schedule. If the performance of an instrument at any time is erratic or such as to cause a distrust of its readings, it is thoroughly investigated and either adjusted satisfactorily or returned to the factory. When it is necessary to calibrate an instrument it is adjusted to within one-half of the schedule limits.

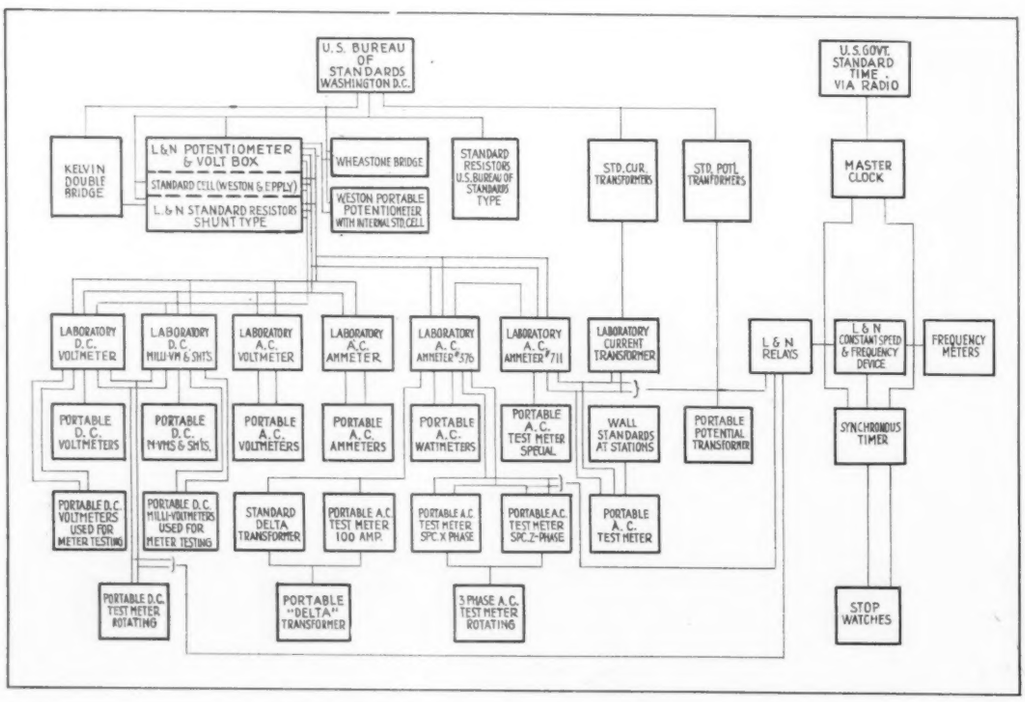
Rotating standards and instruments used by testers and inspectors, as well as laboratory instruments and equipment, must be kept clean and in good repair. Dirty or defective instruments and equipment leave a bad impression on the public and also have a bad effect on the man using them. Extra cases for standards and instruments are carried in stock and old or defective cases replaced or repaired. Extra instruction cards are also kept in stock so that worn or dirty cards may be replaced.

•

Start and Stop Turbine Speed Record

Records of starting and stopping speeds are about all that are required from a curve-drawing tachometer on a turbine. When the unit is on the line its speed is perfectly recorded by the frequency instruments and it is simply a waste of record paper to operate the tachometer all the time the unit is running. In the Valmont station of the Public Service Company of Colorado the tachometer is set up in an arrangement by which only starting and stopping speeds are recorded.

The tachometer is mounted on a frame so that its drive pinion may be moved into and out of engagement with the turbine shaft. Included in the tachometer mounting is a contact by which the synchronous motor driving the curve-drawing instrument is put into operation when the tachometer is engaged just before the turbine is started. Then when the unit is on the line the tachometer is moved back. When the unit is to be shut down the tachometer is moved into engagement again.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L. & N. STANDARD RESISTORS SHUNT TYPE
WHEATSTONE BRIDGE
WESTON PORTABLE POTENTIOMETER WITH INTERNAL STD. CELL
STANDARD RESISTORS U.S. BUREAU OF STANDARDS TYPE
STD. CUR. TRANSFORMERS
STD. POTL. TRANSFORMERS
MASTER CLOCK
LABORATORY D.C. VOLTMETER
LABORATORY D.C. MILLI-VM & SHTS.
LABORATORY A.C. VOLTMETER
LABORATORY A.C. AMMETER
LABORATORY A.C. AMMETER #376
LABORATORY A.C. AMMETER #711
LABORATORY CURRENT TRANSFORMER
L & N RELAYS
L & N CONSTANT SPEED & FREQUENCY DEVICE
FREQUENCY METERS
PORTABLE D.C. VOLTMETERS
PORTABLE D.C. M-VMS & SHTS.
PORTABLE A.C. VOLTMETERS
PORTABLE A.C. AMMETERS
PORTABLE A.C. WATTMETERS
PORTABLE A.C. TEST METER SPECIAL
WALL STANDARDS AT STATIONS
PORTABLE POTENTIAL TRANSFORMER
SYNCHRONOUS TIMER
PORTABLE D.C. VOLTMETERS USED FOR METER TESTING
PORTABLE D.C. MILLI-VOLTMETERS USED FOR METER TESTING
STANDARD DELTA TRANSFORMER
PORTABLE A.C. TEST METER 100 AMP.
PORTABLE A.C. TEST METER SPC. X PHASE
PORTABLE A.C. TEST METER SPC. 2-PHASE
PORTABLE A.C. TEST METER
PORTABLE D.C. TEST METER ROTATING
PORTABLE "DELTA" TRANSFORMER
3 PHASE A.C. TEST METER ROTATING
STOP WATCHES

Detroit Edison instrument standardization

ER Utilization

ASSURES A BETTER PLANT — PRODUCT — PROFIT

"PLANNED POWER TRANSMISSION" insures increased and more effective power utilization. It means greater production efficiency, flexibility to accommodate future changes, lower maintenance costs, lower power costs and — increased profits.

"Planned Power Transmission" means the selection of power drives best suited for individual operating conditions and the proper combination of individual and group drives which will get the power from source to driven machine most effectively and with minimum loss.

Engineers of the Power Transmission Council—collaborating with plant, consulting and power engineers and members of the Nation's Power Transmission Clubs—are constantly conducting power transmission surveys in many different industries. In some cases they have found power wastes running as high as 38%. Without fees or obligation of any kind their findings have simplified production flows, insured fewer service interruptions and cleaned up shop appearance.

Power Transmission Council engineers have no special cause to plead — no one type of drive to recommend. They are interested solely in selecting the *combination* of drives best suited to each particular case. This is the consultive service manufacturers may have by addressing the Power Transmission Council. Why not check your own production flow — in the interests of a *better plant — product and profit!*

1. NATIONAL ORGANIZATION: The Power Transmission Council is the official spokesman for the Power Transmission industry. It is incorporated under the laws of the State of Delaware. It is committed to a broad program in behalf of more effective power utilization in industry.

2. SOUND ENGINEERING: Only one laboratory is recognized by Power Transmission Council—the industrial plant. From studies made by competent and experienced engineers facts have been accumulated which guide recommendations and are available to industrial executives in the form of Case Studies.

3. REGIONAL ENGINEERS: A staff of competent power transmission engineers is maintained in leading industrial centers. They deal with facts—their recommendations are unprejudiced — their goal is more effective power utilization through planned power transmission.

4. LOCAL ENGINEERING ORGANIZATIONS: 3,500 members of Power Transmission Clubs in industrial centers, affiliated with the national organization and working in cooperation with Regional Engineers are daily assisting industrial executives in the solution of their power transmission problems.

5. EFFECTIVE MERCHANDISING: The facts accumulated as a result of the Council Research program are used as a basis for a broad educational program and are widely distributed in the form of many valuable publications covering the many phases of industrial power transmission practice. Write headquarters for a complete list.

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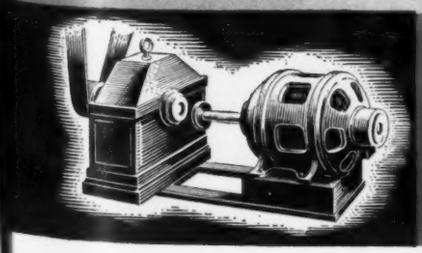

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New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

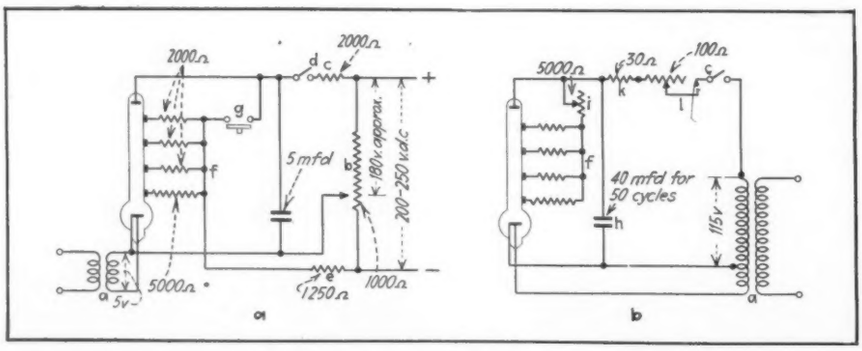
Use Mercury Vapor in Stroboscopic Tube

Electrical discharge tubes, unlike flicker disks and neon lamps, have no thermal lag and therefore lend themselves to stroboscopic applications where very short flashes of light of high intensity are desirable to make visual and photographic examination of moving apparatus easy. A low-pressure, mercury-vapor, hot-cathode stroboscopic tube of this type has been developed by the British Thomson-Houston Company. This tube, described in *Engineering*, London, uses an indirectly heated cathode which is placed in the bulbous end of the tube, connections to this cathode and the heater being made through an ordinary screw base. Both contacts of a bayonet cap at the other end of the tube are connected to the anode. Four starting electrodes are brought out to small cylindrical caps at the side of the tube.

The indirectly heated cathode of this type tube consumes 10 amp. at 5 volts. The peak anode voltage is from 100 to 260 volts and the operating current is about 1 amp. r.m.s., depending on the duty cycle. The apparent duration of the flash is dependent on the operating circuit, but is about 10 microseconds, while its frequency is about 500 per second.

Circuits used for operating this tube are arranged so that the anode current return lead to the cathode is taken to the shell of the screw base. A switch is also inserted in the anode circuit and must not be closed until the cathode has been energized for about fifteen minutes. This insures that the correct operating temperature has been reached and prevents damage from the passage of high peak currents.

The accompanying diagrams illustrate two types of circuits for operating the tube. The circuit (a) is for operating the tube by the closure of a contact. The operating switch can be arranged so that it closes at a certain point in the rotation of the mechanism being studied, causing the tube to flash at this point. The circuit will give only one flash at a time irrespective of the length of time that the key is closed. Circuit (b) is for use in instances where it is desired to have the frequency of the flash controlled by the frequency of the supply, as this represents a constant value of large inertia.



Low-pressure mercury vapor tube has range of applications in stroboscopic work

(a) For single-flash operation at frequencies from 0 to 3,000 per minute operating switch *g* is actuated by mechanism to be studied. There is an optimum point on the potentiometer for each frequency. Current capacity of potentiometer *b* should be 0.5 amp. (b) For operation at the same frequency as the supply voltage this circuit may be used. By varying the sliders on the resistances *l* and *i* an optimum point of definition will be obtained and the time constant of the circuit may be adjusted to avoid obtaining two flashes per cycle of supply.

•

Synchronous Meshing of Turning Gear

Until recent years the usual practice when a steam turbine with a turning gear is being shut down is to not let the unit come to a complete stop, but to mesh in the turning gear at the proper time to keep the rotor rolling slowly, and thus prevent unequal stresses being set up in the rotor metal as well as avoiding a warped spindle. With the device which is in use on No. 1 unit in the Valmont station of the Public Service Company of Colorado it is not necessary to guess whether the proper speed is attained before meshing in the turning gear. The turning gear is engaged when the falling speed of the turbine becomes equal to the speed of the turning gear, about 29 r.p.m.

The device is a simple form of stroboscope. On the turning gear is a timer similar to the type used on the old Model T Ford motor. The timer makes contact in the primary of an automobile spark coil. The secondary of the coil energizes a neon lamp. On the shaft of the unit between the turbine and the generator are painted a

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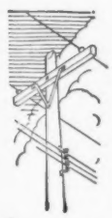
SINGLE-PHASE TRANSFORMER INSTALLATION *featuring* MODERN PROTECTIVE EQUIPMENT

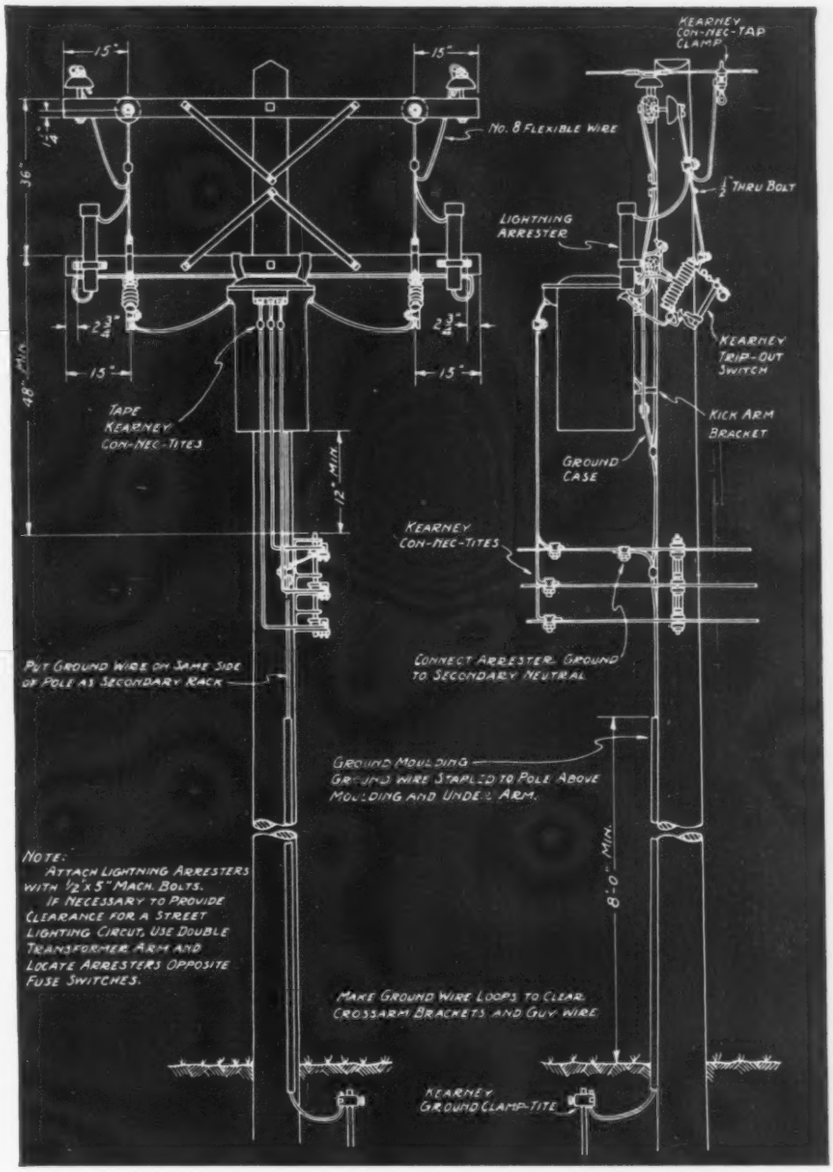


Shown here is an arrangement for a 115-230 volt, single-phase transformer with the case grounded, and a common ground for the secondary neutral, transformer case and lightning arresters.

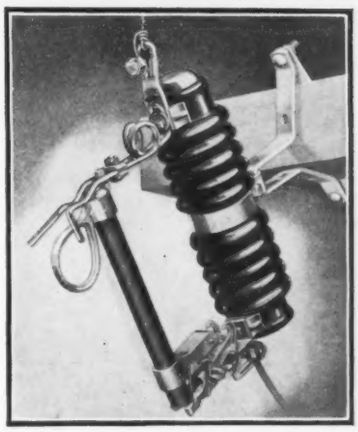
You will notice that this installation is particularly neat and safe and affords full protection from overloads and short circuits as well as protection against lightning surges.

Protective equipment used, you will notice, is all Kearney. Con-Nec-Tites make connections without use of solder pot; Con-Nec-Tap Clamps connect arrester and Trip Out Switch to the hot line, while the specially designed Kearney Ground Clamp-Tite has been properly installed at a distance from the pole, and below the earth's surface, to give a positive ground. All modern protective equipment for a modern and dependable job.

Reprints of this ad and others —"Blueprints from a Special Handbook," will be sent on request.



Investigate the special design features that have been incorporated into Kearney Trip Outs and which are available in a complete range of capacities for your requirements.



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number of black lines parallel to the axis of rotation. The relationship between the speed of the timer and the number of lines on the shaft is such that under the neon light the lines appear to be stationary when the shaft speed is 29 r.p.m. The turning gear is then engaged and continues to roll the unit at that speed. The wear and tear occasioned by engaging the gearing at improper speeds is thus eliminated.

•

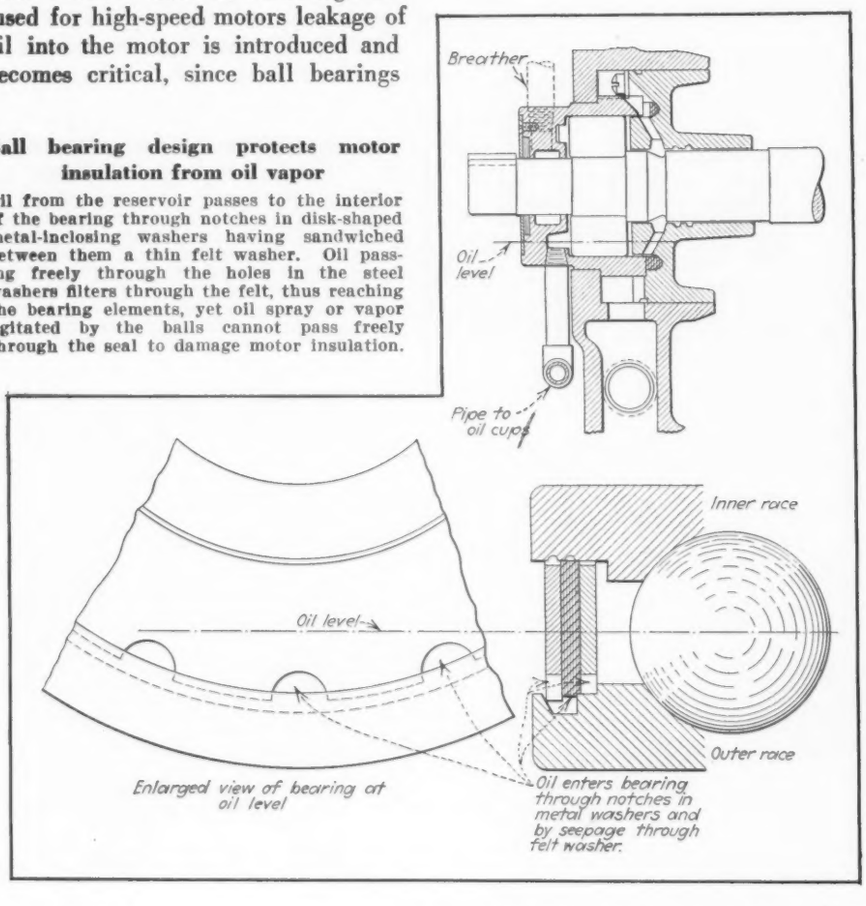
Oil-Sealed Bearing Protects Insulation

By J. L. BROWN
Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Growth in the application of ball bearings to electric motors has come about as a result of oil leakage from the older types of housings of plain bearings and the consequent destruction of motor insulation. Ball bearings for medium and low speed can be successfully lubricated with grease which is retained in housings without difficulty. For high speeds, however, grease lubrication is generally less satisfactory and oil lubrication is used. Where oil-lubricated ball bearings are used for high-speed motors leakage of oil into the motor is introduced and becomes critical, since ball bearings produce more agitation than sleeve bearings.

To meet this problem a new sealed ball bearing has been developed by the Westinghouse Electric & Manufacturing Company for motor application which permits the rolling elements of motor bearings to dip in oil without developing oil spray or vapor within that part of the bearing housing external to the bearing proper. Leakage of oil from the bearing housing is thus successfully prevented and motor insulation protected.

Spray-making elements of the bearings are inclosed in a chamber which is in turn inclosed in the housing. Oil reaches the elements of the bearing through notches in metal-inclosing washers which have a thin felt washer sandwiched between them. While the seal will admit oil to the interior of the bearing, its novelty lies in its ability while doing this to prevent escape of oil spray and vapor from the interior of the bearing to the surrounding housing chamber. Any oil spray or vapor which would otherwise escape through running clearances or through openings in the sealing washers is caught by felt at such points and retained by its capillarity, settling slowly to the lower edge which is submerged in oil.


Breather
Oil level
Pipe to oil cups
Inner race
Oil level
Outer race
Enlarged view of bearing at oil level
Oil enters bearing through notches in metal washers and by seepage through felt washer.

Ball bearing design protects motor insulation from oil vapor

Oil from the reservoir passes to the interior of the bearing through notches in disk-shaped metal-inclosing washers having sandwiched between them a thin felt washer. Oil passing freely through the holes in the steel washers filters through the felt, thus reaching the bearing elements, yet oil spray or vapor agitated by the balls cannot pass freely through the seal to damage motor insulation.

System-Coupling Converter Set

The Societa Tecnomasio Italiano Brown-Boveri of Milan is at present constructing a unique system-coupling converter set for the works of the Acciaierie e Ferriere Lombarde Falck-Milano at Spigno Monferrato, Italy. Details are reported in the (British) *Electrical Review* of August 6, 1937.

A vertical-shaft synchronous machine is connected to the three-phase system of the Italian State Railways. It is designed for an output of 9,000 kva. at 500 r.p.m., 3,500-4,000 volts, 16 2/3 cycles, and is coupled, on one side, to a hydraulic turbine and, on the other, to an induction machine to allow, alternatively, of connecting up to the 6,300-volt, 50-cycle and 5,100-volt, 42-cycle industrial systems. The frequency changer for the separately placed Scherbius regulating motor is on the same shaft above the induction machine and over the supporting bearing at the top and on the same shaft there is also a small auxiliary generator.

Apart from the arbitrary and alternative exchange of power between the two systems, independently of the frequency fluctuations of the system, or solely dependent on the frequency oscillations on the railway system, the following operations are possible:

When connected to the Scherbius regulating motor the induction machine can run as a pure phase advancer, its reactive output being 5,000 kva. at 6,300-volts, 50 cycles and 4,000 kva. at 5,300 volts, 42 cycles; it can run as an induction generator and also as a phase advancer, the commutator machine regulating the reactive loads so that the generator delivers between 6,500 kw. at 100 per cent power factor and 7,500 kva. at 0.86 p.f. when connected up to 6,300 volts and 50 cycles. When connected up to 5,300 volts, 42 cycles the generator can give 5,400 kw. at unity power factor and 6,300 kva. at 0.86 power factor.

The active power delivered by the generator is covered by the hydraulic turbine. The induction machine can, however, also work, unconnected to the Scherbius unit, as an uncompensated induction generator giving 6,500 or 5,400 kw. at 0.86 power factor to the 50- or 42-cycle industrial systems, respectively.

VIBRATION DETECTIVE!

This man is not testing every "tenth" or "twentieth" motor in what is customarily called "production control inspection." He is one of a large staff that inspects *each* motor which Fairbanks-Morse manufactures to make certain that every F-M motor is what maintenance men call "sweet running." Without the approval of these inspectors no motor can bear the familiar F-M trade-mark.

The vibrometer which this inspector is using transforms a thousandth-of-an-inch deflection into a swinging beam of light. He is thus equipped to make certain that rigid Fairbanks-Morse standards are rigidly maintained. This inspection insures your getting an accurately balanced motor, so smooth in performance that it will give you extra years of maintenance-free service.

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Motors

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Arc Welding Boosts Tanker's Oil Capacity

The tanker *Studerus*, first vessel built on the new arc-welded "free flow" frame system, can carry 53 per cent greater loads than would be the case with a riveted frame of equal weight, according to the designer, Johanes Kjekstad, consulting engineer for the builder, United Dry Docks Inc., New York City.

Savings in weight with this system of construction amounted to about 20 per cent in the weight of the frames and stiffeners—permitted either the use of heavier shell plating, lower total weight or greater cargo carrying capacity with the same displacement. Since the welding area is confined to lugs, spaced at comparatively wide intervals, detrimental stresses or distortions cannot develop, it is said. Maintenance of a vessel built on the "free flow" system is considerably less due to the fact that no hiding places are left for corrosion to start, no gas pockets, no sludge panels, no place which cannot be readily cleaned or painted.

According to a number of tests made by the builder of the *Studerus*, the free flow system of arc-welded construction has a 27 per cent higher structural efficiency against deflection and 14 per cent less permanent set.

Use of the free flow frame system of welded construction is anticipated in building larger vessels due to its greater strength, reduced weight and simplicity of maintenance.

Lincoln Electric Co.

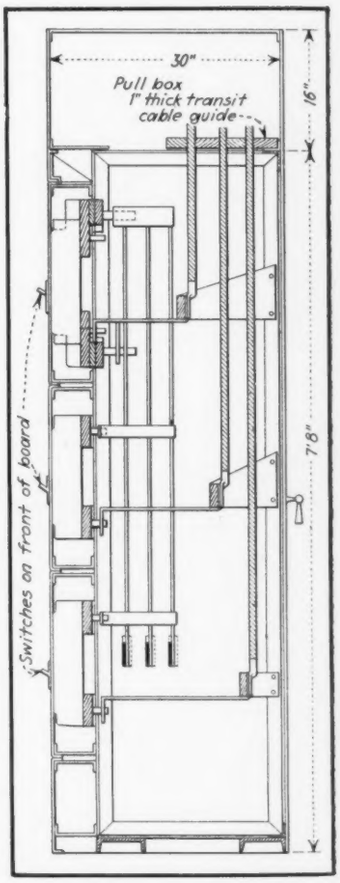
Arc-welded construction increases cargo carrying capacity of 40,000-gal. tanker

•

Safe to Use a "Clip-on" Ammeter

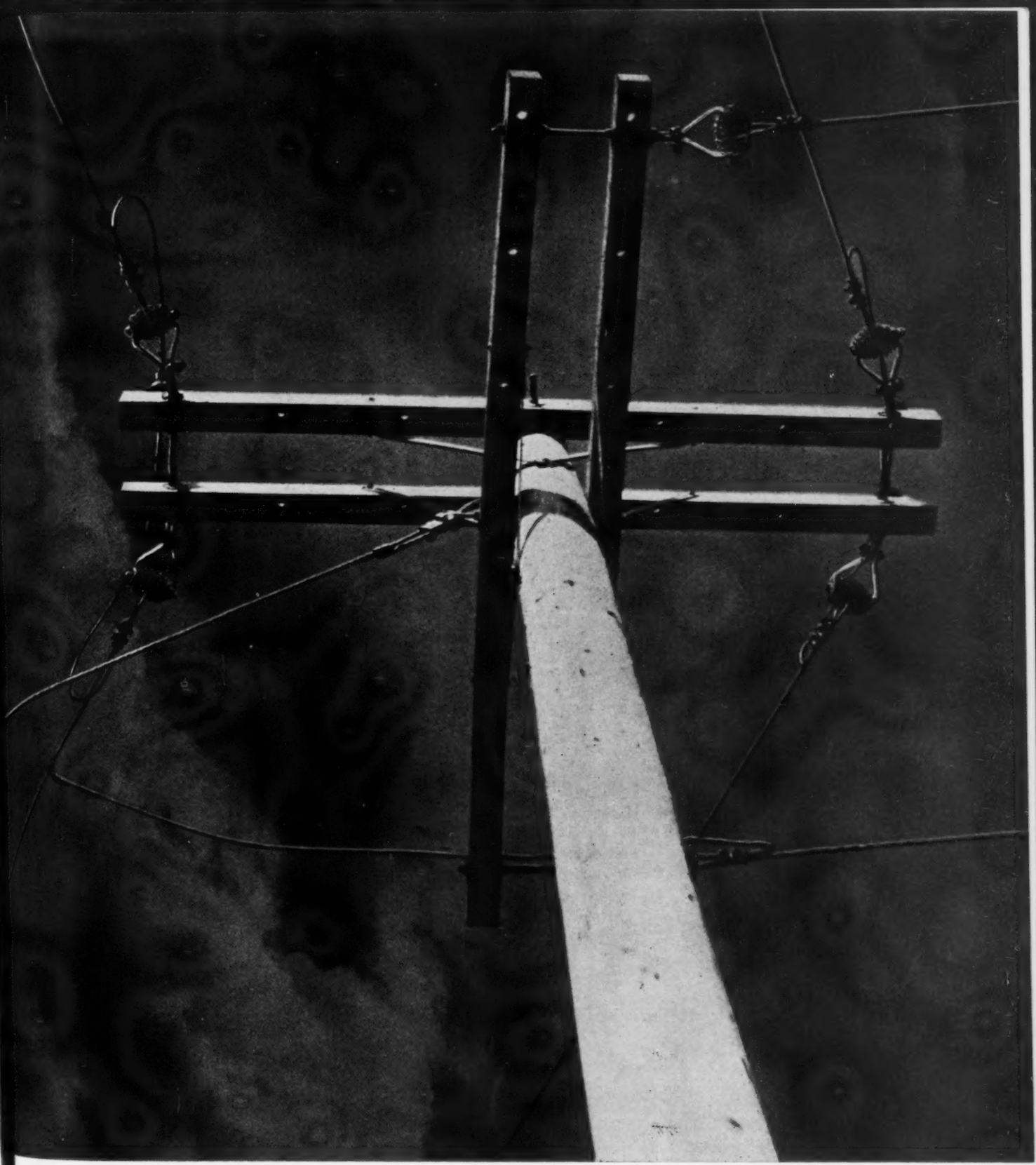
By R. B. STRASSEN
Electrical Engineer
Owens-Illinois Can Company, Chicago

Frequently it is desired to know the load at the switchboard on an industrial plant circuit. For this purpose an ammeter of the "Clip-on" type is very handy. But sometimes it is hard to find a place on the conductor where the instrument may be applied with safety and ease. This is particularly true of power service entrance and distribution boards where the conductors are rigid copper bars, uninsulated, and therefore rather dangerous to work on. But this difficulty does not arise in the Clearing (Chicago) plant of the Owens-Illinois Can Company because the power switchboard was designed to avoid it.



Cables replace busbars in power cubicle and facilitate ampere readings with Clip-on meter

As appears in the accompanying section drawing the board is like many others of its steel cubicle type—safety breakers on the front, pull box across the top and doors at the back. But there is a difference; instead of rigid bars rising to terminals in the pull box where connections are made to outgoing cables, the cables pass right



HANG THE LOAD on HUBBARD HARDWARE

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through the box down into the bus space, where connections are made direct to the bars from the switches. The cables replace the bar risers. When the electrician, with the "Clip-on" ammeter in his hand, opens the back of this cubicle, he sees vertical runs of insulated cable to which he can apply the instrument with perfect ease and safety. Also, this manner of construction is somewhat less expensive, since it saves labor in cutting, drilling and fitting bars, as against the cost of making the cables a little longer.

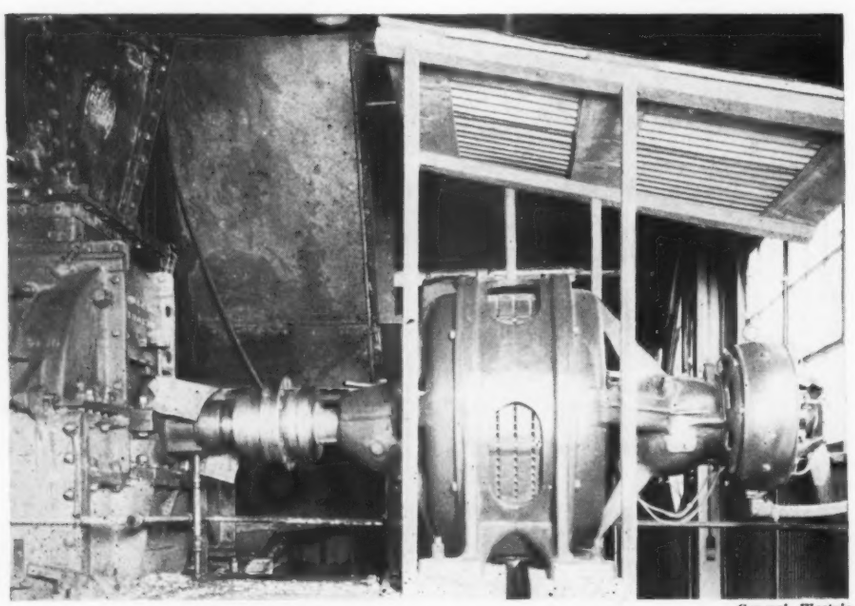
•

Synchronous Motor Maintenance Hints

By K. B. HUMPHREY
Sayreville, N. J.

Maintenance of synchronous motors may be classified under the following heads: (1) Cleaning. (2) Bearing care. (3) Commutator and slip ring care. The first two are common to any type of motor to a greater or less degree.

Cleanliness is especially important in motors of large horsepower where high voltages are used (2,300 volts and up). A regular cleaning schedule should be worked out to keep dust within bounds, since dust on the windings and frame will act as a heat insulator and prevent proper cooling. Some types of dust may be detrimental to the insulation itself. Where it is impossible to eliminate dust a regular cleaning with a portable fan should be undertaken. Some companies make it a practice to take the machine down at stated periods, wash out accumulations of dirt and use air-drying varnish on all windings.



General Electric

Roof over fuel hog drive keeps droppings out of synchronous motor. Motor is rated as 175 hp., 900 r.p.m., 2,200 volts, 0.8 p.f. and has direct-connected exciter

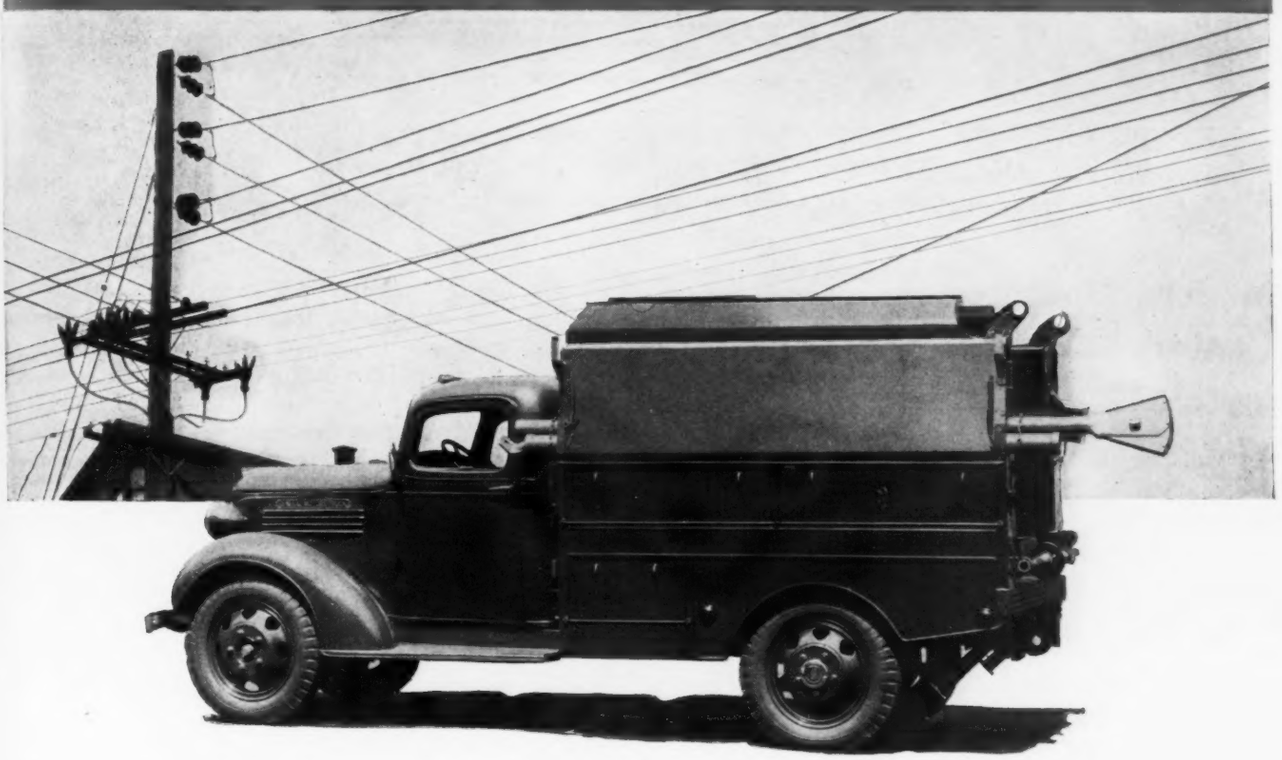
Clearance between the exciter armature and field is the determining factor affecting bearing replacement in cases where the d.c. exciter is mounted on the main motor shaft. Clearance should be checked at regular intervals, once a year at least, against the tolerance obtained from the motor manufacturer. Although it is possible to renew the exciter end bearing without changing the two other bearings, this is not usually good practice. Where oil rings are used to feed the bearing it is customary in one large plant to inspect them at least once a day to see that they are operating properly.

Commutator and slip rings should be kept clean. At regular intervals the brushes should be removed and scraped smooth at the contact surface. If a small bit of carbon gets imbedded in the carbon it will cause scoring of the commutator. In one plant a commutator dressing stone is used about once every six months and no trouble has been had with commutators. Should a commutator get in bad condition it should be turned down in place or in the shop.

KEEPS DUST OUT OF AUTOMATIC PHONE ROOM

Believing that much of the trouble in automatic telephone exchanges is due to the dust in the air, the Bell Telephone Company has installed an electrostatic air cleaner in its Sterling exchange, Pittsburgh, Pa. This air cleaner, developed by the Westinghouse Electric & Manufacturing Company, removes more than 99 per cent of the solid particles from the air passed through it. The installation is expected to reduce considerably the relay maintenance and cleaning costs.

Dependable AS THE SERVICE THEY HELP TO MAINTAIN



Illustrated: No. 1954, construction and maintenance unit, suitable for service on any standard 1 ton to 1½ ton chassis. Other Baker equipment includes— Line Construction and Maintenance Bodies; Light, Medium and Heavy Duty • Telephone Installation and Service Bodies • Cable Splicer Trailers • Pole and Material Trailers • Aerial Ladder Units • Winches and Power Take Offs • Pole Derricks • Reels

PUBLIC UTILITY
Baker
BODIES & EQUIPMENT

Engineered to meet the exacting requirements of Utility installation and maintenance, Baker All-Steel Bodies are backed by over 80 years of experience in building commercial vehicle bodies. In them you will find, as other Operating Executives have found, the combination of high efficiency, long life and low operating cost so urgently demanded by today's conditions.

Write today for the catalog and full details on the Baker All-Steel Line. You'll find its information useful in meeting your equipment requirements.

THE BAKER-RAULANG COMPANY
BODY DIVISION: WEST 80TH STREET • CLEVELAND, OHIO

BODIES AND EQUIPMENT FOR EVERY UTILITY PURPOSE

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Modern Lighting for Century-Old Church

By ROY A PALMER
Illuminating Engineer, Duke Power Company
Charlote, N. C.

Installation of flushed-in lighting units in the First Presbyterian Church at Charlotte, N. C., provides an average intensity of 10 ft.-candles over the seating area and preserves the beauty of the century-old structure.

Since 1895 three combination gas-electric chandeliers have lighted the auditorium. Of graceful design and studded with thousands of prisms, they provide a very decorative effect. In the days when these chandeliers were first installed carbon lamps, low in brilliance, were used to supplement the gas lighting. When the tungsten-filament lamps appeared they replaced the carbon-filament lamps, with a corresponding increase in brightness. With subsequent improvement in incandescent lamps the brightness became more excessive and consequently became a source of considerable discomfort to the congregation. Denser glass shades would not reduce the brightness sufficiently unless they were larger in size, which would give a clumsy, unsightly appearance to the chandeliers. To replace these chandeliers with new fixtures designed for today's high-brilliancy light sources was strenuously objected to by the congregation because of the sentiment attached to the existing fixtures.

Incidentally, the 60-watt lamps in the chandeliers were replaced by 7½-watt lamps, thus reducing the brightness well below tolerable limits and yet illuminating the chandeliers quite adequately from a decorative standpoint. The light from the in-built boxes streaming through the chandeliers creates a sparkle in the many prisms that enhances the beauty of the chandeliers.

Twelve Holophane lens boxes (FP-58871) are recessed flush with ceiling in two rows through the center of the church. Each unit is equipped with two 300-watt lamps; lateral distance between lighting centers is 8 ft. 4 in. Longitudinal spacing varies from 13 to 17 ft. Three Holophane lens box units (FP-58872), shown near the top of picture (b), high-light the rostrum. Each equipped with one 200-watt lamp, the built-in boxes are mounted at an angle directed toward the rostrum, 15 ft. in front of the pulpit. An idea of the former disagreeable brightness of the chandeliers is given in (a).

Church lighting has calculated average intensity of 10 ft.-candles

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Conditioning Adds to Profits in Eat Shop

Evidence of what air conditioning will do to increase restaurant business is indicated by a business increase of 25 per cent in Miss Morris' Eat Shop, Minneapolis, Minn. This restaurant about a year ago had a complete, year-around air-conditioning system designed and installed by Beecher-Cummings, Inc., distributor for Westinghouse Electric & Manufacturing Company, manufacturer of air-conditioning equipment. The installation

All Cats
ARE GRAY IN THE DARK

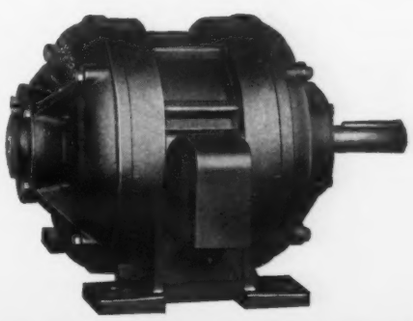
. . . but most motors look alike even in daylight. However, there are as great differences in the sturdiness of motors as there are in the color of cats. It is sturdiness that prolongs the life of a motor and reduces maintenance costs and Allis-Chalmers Motors are the sturdiest motors on the market—bar none.

Do you want to prove this to yourself?

Then don't just compare dimensions and electrical characteristics, for they are identical in most motors; prices are also about the same. It is the workmanship, the materials and the construction of motors that you should examine carefully, critically, before purchasing.

Careful examination of Allis-Chalmers Motors will reveal: ample insulation, with a big margin added for mechanical durability . . . studied use of steel throughout . . . cast steel frames . . . rugged cast iron housings . . . heavy bearing enclosures—that is why they are so sturdy. That is why they are the best motor buy on the market.

For further information write for Bulletin No. 2173.



The Allis-Chalmers Mfg. Co. builds standard motors of every type from 1 hp. up—also motors for special application

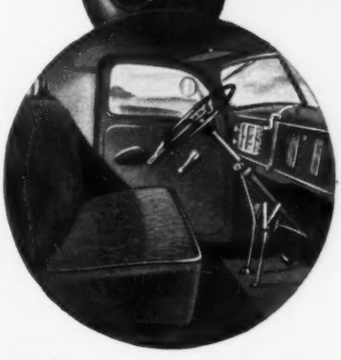
746

MOTOR DIVISION

ALLIS·CHALMERS

MILWAUKEE WISCONSIN

THE *New* INTERNATIONAL PICK-UP TRUCKS IN 3 SIZES



The ALL-STEEL CAB is a feature in every new International. The one-piece top, the sides, the back and cowl panels, are welded into the complete cab frame. Rubber mountings wherever cushioning is needed. This is the roomy, well-appointed de luxe cab.

½-Ton Model D-2
¾- to 1-Ton Model D-15

The International ½-ton Model D-2 comes in two wheelbase lengths, 113 and 125 inches; inside body 76 and 88 inches long. The ¾- to 1-ton Model D-15, wheelbase 130 inches; inside body 102 inches long.

● An unusual choice is offered the light truck user in the Half-Ton to One-Ton range in the new International line. There are wheelbase lengths and body dimensions to fit all light hauling requirements. And it is that way throughout the entire International line. No matter what the load, there is always an International built to fit the job, exactly.

International Harvester engineers worked for months to develop these trucks—a quality line of Internationals completely new in engineering and exterior design. The men who design and build and test them took all the time that this kind of a job requires and put into it all the experience that Harvester has gathered in more than thirty years of truck manufacture. And now months of actual service in every kind of job imaginable testify to a new high accomplishment in truck construction and a new low cost in truck operation.

Every one of these new Internationals, from the modern Half-Ton streamline trucks to the powerful six-wheel units that are licking the toughest trucking conditions in the world, is *all-truck* throughout as all Internationals have always been.

From the very day a new International goes on the job you can expect greater earnings on every load it hauls. See these trucks now at the nearest International branch or dealer showroom. The right chassis and right body for every hauling problem. Ask for catalogs of the sizes in which you are interested.

INTERNATIONAL HARVESTER COMPANY
Harvester Building (INCORPORATED) Chicago, Illinois

INTERNATIONAL TRUCKS

Ten Average Monthly Bills

A Few of the Thousands of Customers in Kansas City Who Enjoy Electric Cooking

Customer	Number in Family	Number of Rooms in House	Electrical Appliances Besides Lamps	April, 1937 Total Electric Service Bill	Cost of Operating Range Alone, One Month
Mrs. J. M. Nolan, 6425 Valley Rd.	5	8	7	$8.55	**$2.96**
Mrs. John R. Fowler, 120 N. Ash	4	5	10	7.55	**1.52**
Mrs. I. F. Lohmann, 7225 Montgall	3	5	7	7.10	**1.85**
Mrs. B. L. Wennerstrom, 3821 E. 67th Terr.	4	5	7	9.15	**2.50**
Mrs. E. G. Lawter, 5810 Walrond	2	4	5	5.05	**1.30**
Mrs. Chas. Gallagher, 653 Lewis	4	4	7	4.95	**1.40**
Mrs. H. C. Newhall 112 So. Monroe	3	6	8	6.75	**1.85**
Mrs. A. E. Payne, 1506 Appleton	3	4	7	6.45	**1.70**
Mrs. F. M. Schultz, 216 E. 81st St.	5	5	5	6.05	**3.16**
Mrs. John J. Walsh, 4428 Flora	5	5	7	4.80	**1.78**

General Average Cost of Operating These Ten Ranges for the Month..... $2.00

As part of its campaign to popularize electric cooking, the Kansas City Power & Light Company ran this full-page ad in both local newspapers. Reports of salesmen contacting customers indicate it as an unusually effective scheme. Plan now is to follow up the ad with a booklet giving fifty users' actual bills, with photos of users or their houses.

has been more than justified by the increase in business and profits according to the management of the restaurant.

The profits from the increase will pay the entire cost of installation and operation, as follows:

Electricity per year	$60.00
Water per year	153.00
Filters per year	72.00
Interest per year	180.00
Depreciation per year (for ten years)	300.00
Total annual cost	$765.00

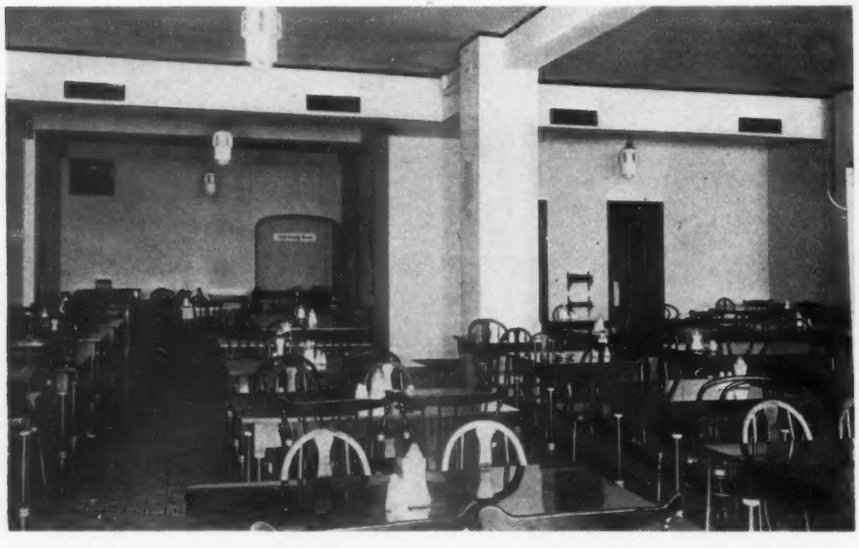
The net profit from a 25 per cent increase in business will amount to at least $2,500 before deducting the expense for air conditioning, or a net of $1,735 per year. The system was purchased on a 36-month F.H.A. contract. By the time it is paid for, with three years operating expense added, the entire cost at that time will be $4,200. The added profits due to its installation will be at least $7,500, leaving a credit balance of $1,100 per year for the first three years and $2,200 per year thereafter.

The system is unusual in design in that it includes the conditioning of both the main floor and basement restaurants. Due to the fact that the heating system is a one-pipe gravity job, it was necessary to install a condensation pump and receiver to first lift the condensation from the coil back into the return main. The control of this pump and receiver, of course, is automatic through a float switch.

As the tenant has no control over the steam pressure, some control was necessary. A pressurestat was installed in the steam main at the coil, which closes the fresh air damper in the event that there is less than 2 lb. of pressure at the heater. It will hold the damper closed until steam pressure is restored.

High-velocity grilles and santrols were used for delivering air into the room so that even distribution without drafts was achieved.

A ventilation system was installed in the kitchen of the restaurant with a velocity plate in the range head. The fan for this system was equipped with a variable-speed motor for regulation of the amount of the air handled in the different seasons.



High-velocity grilles for delivering air into the room so that even distribution without drafts was achieved

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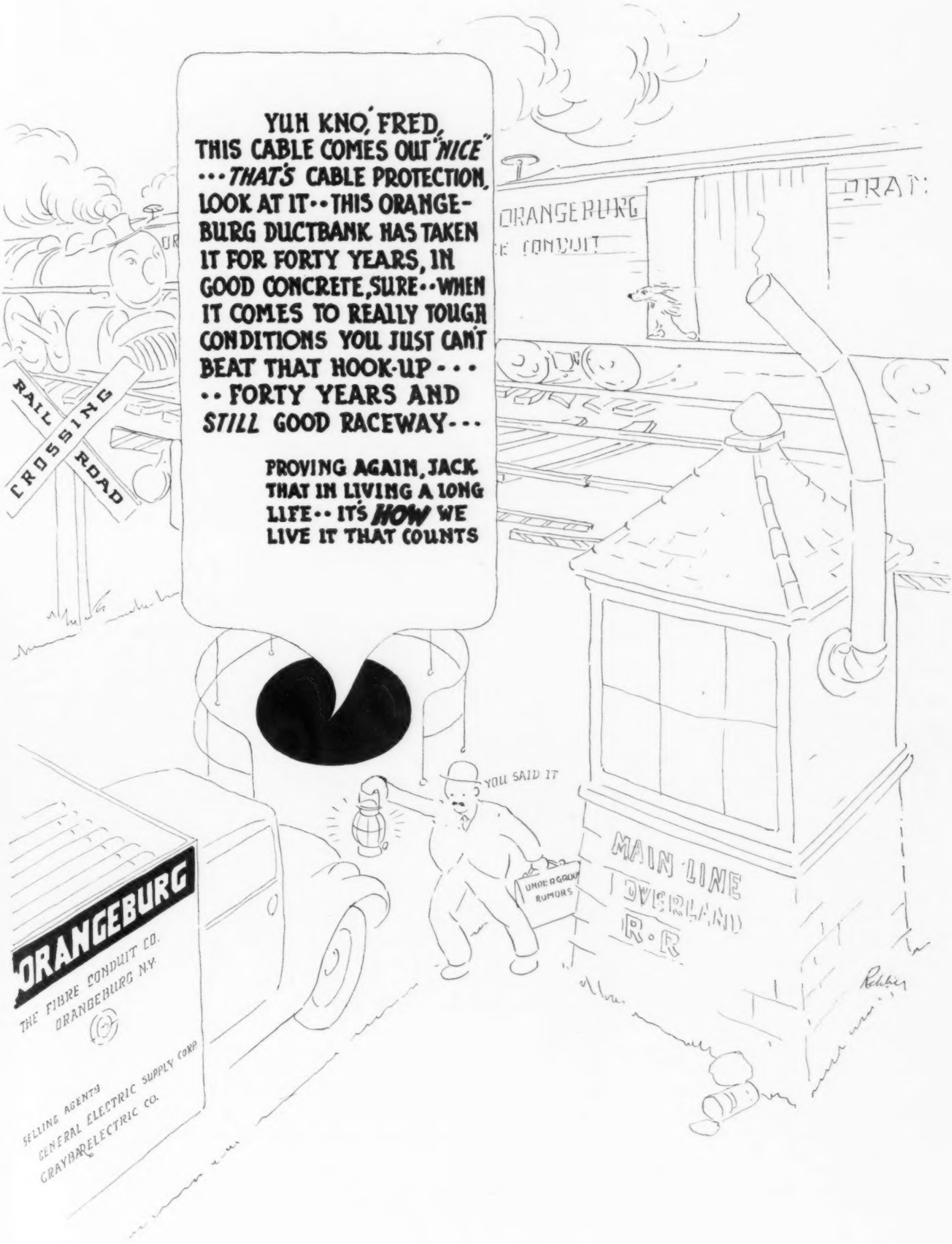
REFRIGERATOR ECONOMY

Here is a novel promotion scheme designed to dramatize the economy of operation of the electric refrigerator. The text by the clock reads: "This Leonard electric refrigerator has been operating the number of days indicated on this Telechron clock." The text by the electric meter says: "This Duncan registering meter shows how little it has cost in electricity to run this Leonard (figured at 3 cents per kilowatt-hour base rate)."


YUH KNO, FRED, THIS CABLE COMES OUT "NICE" ... THAT'S CABLE PROTECTION, LOOK AT IT.. THIS ORANGE-BURG DUCTBANK HAS TAKEN IT FOR FORTY YEARS, IN GOOD CONCRETE, SURE.. WHEN IT COMES TO REALLY TOUGH CONDITIONS YOU JUST CAN'T BEAT THAT HOOK-UP ... .. FORTY YEARS AND STILL GOOD RACEWAY...
PROVING AGAIN, JACK, THAT IN LIVING A LONG LIFE.. IT'S HOW WE LIVE IT THAT COUNTS
RAIL ROAD CROSSING
ORANGEBURG
YOU SAID IT
UNDERGROUND RUMORS
MAIN LINE
R.R.
ORANGEBURG
THE FIBRE CONDUIT CO.
ORANGEBURG N.Y.
SELLING AGENTS
GENERAL ELECTRIC SUPPLY CORP
GRAYBAR ELECTRIC CO.

News ABOUT PEOPLE

North Central Association Elects Executive Officers

J. E. Lynch, vice-president of the Minnesota Power & Light Company, Duluth, has recently been elected president of the North Central Electric Association for the 1937-38 term. Mr.

J. E. Lynch

J. G. Lynch

Lynch has been identified with the Duluth properties since 1929 when he was appointed assistant general sales manager. Two years later he was made general sales manager and in 1936 he was elected vice-president, continuing in charge of the sales department.

Early in his career Mr. Lynch was associated with Stone & Webster and before going to Duluth he was general manager of the Page & Hill Company, Minneapolis, producer and manufacturer of cedar poles.

J. G. Lynch was elected vice-president of the North Central association. He is district manager of the Northern States Power Company at Mankato, Minn.

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▶ FRANCIS J. CARR, comptroller of the Tennessee Valley Authority since its organization in 1933, has resigned to take a position with the United States Steel Corporation in New York.

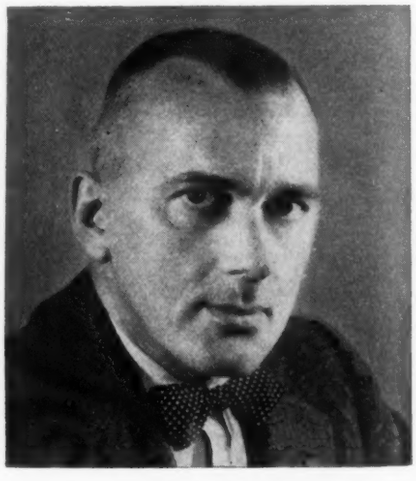
▶ PAUL F. SWASEY, for the past two years sales manager for the Virginia Electric & Power Company at Fredericksburg, has been transferred to Norfolk, where he is now industrial engineer, succeeding L. W. Crump, now in Oklahoma City. Mr. Swasey is a graduate of the Massachusetts Institute of Technology.

▶ THOMAS N. MCCARTER, president of the Public Service Corporation of New Jersey, was the guest of honor at a luncheon held at the Essex Club, Newark, on October 20 to commemorate his seventieth birthday anniversary. Mr. McCarter enjoys the distinction not only of being one of the founders of Public Service, organized in 1903, but of being the only president the company has ever had. He is well known in the utility field by reason of his identification with national associations, in which he has been active for many years. He was the first president of the Edison Electric Institute and served two terms in that capacity. He has also been president of the American Electric Railway Association.

Canariis Made Water Works Electrification Engineer

Svend A. Canariis has been appointed water works electrification engineer for the industrial department of the Westinghouse Electric & Manufacturing Company. In this position his wide experience in promoting the use of modern methods and equipment for water works plants and systems enables him to furnish valuable application engineering assistance to superintendents, engineers and consultants on water works and sewage disposal plant projects.

Before joining the Westinghouse



company, Mr. Canariis was electrical engineer, Bureau of Water, Department of Public Works, for the City of Pittsburgh for seven years. Born in Denmark, he received his degree in electrical engineering from the University of Copenhagen. Since coming to the United States in 1922 he has been connected with many large utility and government projects. He was electrical designer on the Wilson Dam project and senior electrical engineer in the sales engineering department of the Duquesne Light Company.

Mr. Canariis is a member of the

American Institute of Electrical Engineers and of other engineering societies.

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▶L. L. LATHROP, formerly with the Industrial Heater Company, New York, N. Y., is now connected with the New York Power & Light Company at Schenectady, N. Y.

▶GEORGE G. POST, a vice-president of the Milwaukee Electric Railway & Light Company, has been elected vice-president of the Engineers Society of Milwaukee.

▶D. D. FENNELL, consulting engineer of Chicago, was elected president of the National Safety Council at the National Safety Congress held recently in Kansas City, Mo. For a number of years Mr. Fennell specialized in combustion engineering and development of economics in power plants and for the past twenty years he has been a consulting engineer in management problems.

▶E. G. BAILEY, vice-president of the Babcock & Wilcox Company, New York, and president of the Bailey Meter Company, Cleveland, was made the recipient of the honorary degree of doctor of engineering by Lehigh University at Founder's Day exercises at Bethlehem, Pa., October 6. Mr. Bailey received this award for "notable and distinguished accomplishment in the field of combustion and steam engineering." In 1930 Mr. Bailey was awarded the Longstreth Medal by the Franklin Institute and in 1936 the Lamme Medal by Ohio State University.

▶W. A. NEILL has been appointed manager of engineering and sales activities of the Worthington Pump & Machinery Corporation at its recently reopened plant at Holyoke, Mass. Mr. Neill, formerly manager of the corporation's air tool and portable compressor division at Harrison, N. J., will have his headquarters at Holyoke, where the manufacture of portable compressors, rock drills, automotive compressors and vertical compressors is now under way. Before affiliating himself with Worthington in 1934, he was connected with the Denver Engineering Works, Allis-Chalmers Manufacturing Company and with the Dorr Company, Inc., of New York and Denver, Colo.

New Sales Managers Named By Frigidaire Division

Announcement has been made by E. G. Biechler, general manager of Frigidaire Division, General Motors Corporation, of the appointment of J. B. Rushton as sales manager, electric range division, and of W. I. Buchanan as sales manager, electric washer division.

Mr. Rushton is widely known in the electric appliance field, particularly for his success in obtaining wide-

J. B. Rushton

spread use of electric ranges in the area served by the Philadelphia Electric Company of which he was manager of sales production and personnel. Four years ago he joined Frigidaire.

Starting his business career at the

W. I. Buchanan

age of fifteen with the Cadillac Motor Car Division of General Motors, Mr. Buchanan advanced through the ranks and in 1927 became an apartment house refrigerator salesman for Frigidaire. Successive promotions followed to household sales supervisor, apartment house division sales manager, general representative for the department store division and metropolitan sales manager for Chicago, the position he held at the time of his new assignment.

OBITUARY

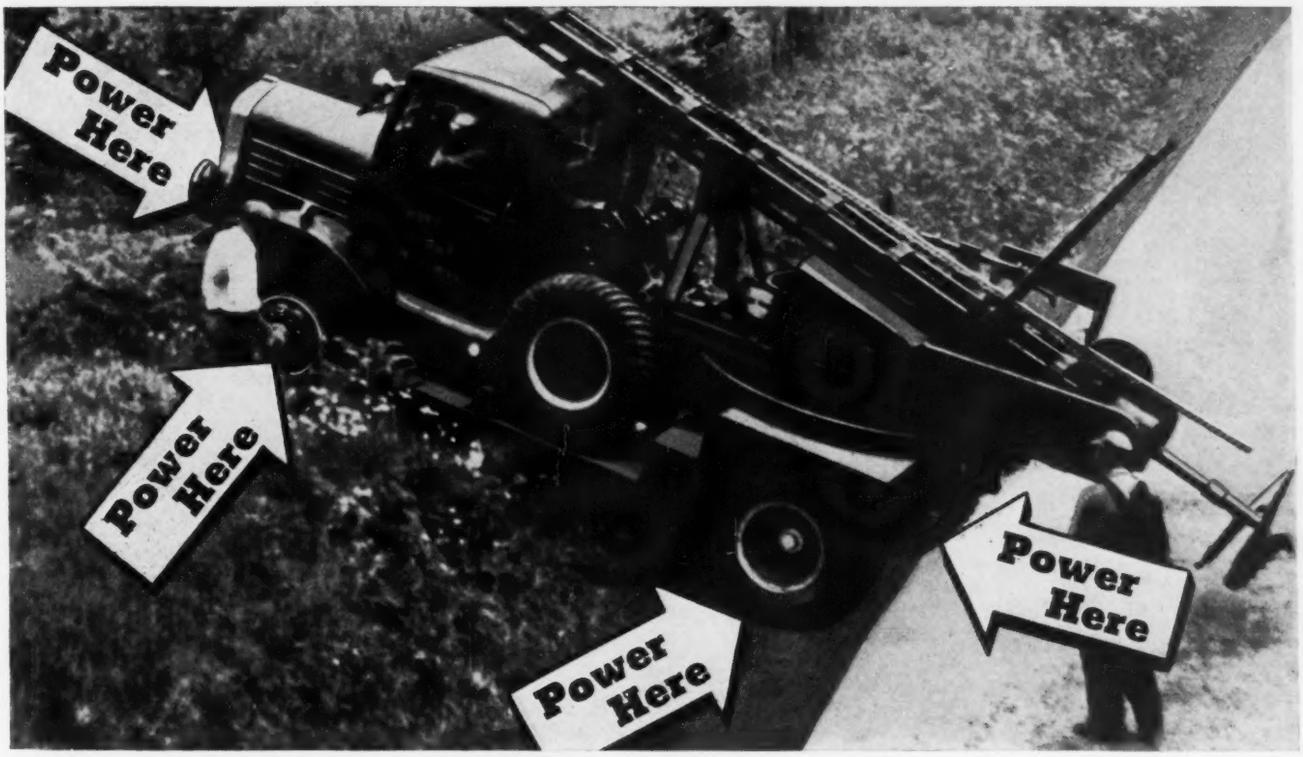
▶FREDERIC C. CHURCH, a director of the Lowell (Mass.) Electric Light Corporation and long a prominent figure in New England industry, died at his home in Lowell October 16, at the age of 80.

▶WILLIAM E. BEST, actively identified with early power developments in the Pacific Northwest, died recently at his home in Seattle, in his sixty-eighth year. Mr. Best retired in 1934 as assistant manager of the central division of the Puget Sound Power & Light Company.

▶DR. BAILEY TOWNSHEND, for the past seven years manager of the research laboratories at the Manville, N. J., factory of the Johns-Manville Corporation, was found dead of poisoning by illuminating gas in his home in Plainfield, N. J., October 18. Dr. Townshend was graduated from the Massachusetts Institute of Technology in 1916. He later served on the teaching staff of M.I.T. and at Yale University. He was 42 years old.

▶AXEL T. SJOBLOM, electric distribution engineer Public Utility Engineering & Service Corporation, died October 22 at Tucson, Ariz. He was en route to Mexico on a business trip when he was stricken by a heart attack. A native of Sweden, Mr. Sjoblom came to this country at an early age and was graduated from the University of Wisconsin. He entered the electrical industry immediately after graduation, his first position being with the Commonwealth Edison Company. From 1911 to 1916 he was in the electrical and mechanical department of the Isthmian Canal Commission in Panama. After practicing as a consulting and sales engineer in Chicago and Minneapolis for three years following the war, he entered the employ of Fairbanks, Morse & Company. In 1926 Mr. Sjoblom was appointed electric distribution engineer of Byllesby Engineering & Management Corporation, now the Public Utility Engineering & Service Corporation.

THE ORIGINAL FOUR-WHEEL-DRIVE TRUCK



POSITIVE TRACTION...

Insures Outstanding Performance

POWER — scientifically distributed over four wheels — instead of only two. That's the engineering principle — the positive traction — that has singled out FWD for outstanding performance — enduring service — unusual economy.

Stress on each driving axle is reduced by half. 100,000 miles and more per set of tires is not unusual. Only 11.8% of the developed power is lost in friction — an amazing performance indeed!

The FWD is a safer truck. It is more economical to operate. It will serve you longer. Not because we say so. But because of exclusive FWD engineering superiorities *which are susceptible of proof.* In the world's toughest trucking — in cross-country oil field and utility construction — in almost impassable timber lands—thru Northern Snow Drifts that would baffle anything but *Four-Wheel-Drive* construction — *Positive Traction* has given FWD an enviable reputation for outstanding performance.

Controlled Power

FWD CONTROLLED POWER GIVES YOU

- Greater Safety
- Faster Service
- Greater Dependability
- Wider Range of Operation
- Operating Economy

FWD

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory, KITCHENER, ONTARIO

FOUR-WHEEL-DRIVE
TRUCKS

THE SAFEST TRUCK ON THE HIGHWAY

Every INDUSTRIAL EXECUTIVE *can profit by reading this* NEW BOOK

16 PAGES
IT'S FREE
45 ILLUSTRATIONS

The world's largest, international engineering fair. 5,000 machines in operation; 2,500 exhibitors; machinery, equipment, tools and processes for every industry; 17 gigantic halls; acres of outdoor displays. Simultaneously, the General Merchandise Fairs. A total of 8,500 exhibitors from 25 countries; 250,000 buyers from 72 countries. *Your firm will find new profits*—whether you exhibit, buy or merely investigate. We invite you to write—on your letterhead—for the new book (No. 28) which describes and pictures the engineering exhibits. There is no charge or obligation. Leipzig Trade Fair, Inc., 10 East 40th St., New York.

The GREAT ENGINEERING AND BUILDING FAIR MARCH 6TH TO MARCH 14TH

A DIVISION OF THE 700-YEAR-OLD
LEIPZIG TRADE FAIRS

Copper Brazing Lowers Bus Jointing Cost

[*Continued from page 66*]

Field Cost of Bolted Joint (Drilled Holes)
(6x½-in. bus, 6-in. lap)

Labor (rate as above) based on drilling ten ½-in. clearance holes with power-driven drill press (five in each 6x½-in. bus)	$2.00
Labor for assembly	1.05
5½x1½-in. steel bolts, nuts and washers	0.40
Copper ($0.18 base) bars at right angle—lapping 6 in.	1.03
Miscellaneous expense	0.05
Field cost total	$4.53

Amount saved by using brazed joint = $4.53 —1.80 = $2.73

Field Cost of Bolted-Punched Holes
(6x½-in. bus, 6-in. lap)

Punching holes (10)	$1.20
Labor—extra filing	0.30
Labor for assembly	1.65
5½x1½ steel bolts, nuts and washer	0.40
Copper ($0.18 base)—lap same as drilled joint	1.03
Miscellaneous expense	0.05
Field cost total	$4.03

Amount saved by using brazed joint = $4.03 —$1.80=$2.23.

Field Cost of Clamped Joint
(One pair of 6x6-in. cast-iron clamps)

Labor for assembly (wage rate same as above)	$0.75
1 pair of cast-iron bus clamps	4.85
Copper ($0.18 base)—lap same as drilled or punched joint	1.03
Miscellaneous expense	0.05
Field cost total	$6.68

Amount saved by using brazed joint=$6.68—$1.80=$4.88.

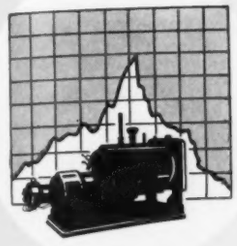
Our field labor cost, as noted above, includes field supervision, such as foreman's time and other non-productive items, but does not bear any burden for overhead or allowances for insurance, taxes, etc.

It also will be observed that the field cost of material per square inch of joint on ½x6 in. was 71 per cent more in the field than in the laboratory, (*i.e.*, $0.064—$0.11 per square inch) and is accounted for largely by the greater consumption of gas under actual working conditions.

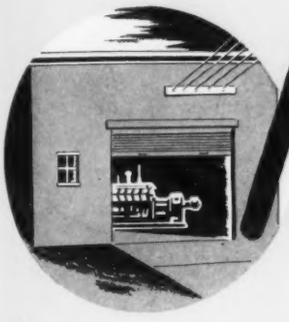
While the joining involved in this installation primarily had to do with busbars carrying heavy currents at low voltage, it also has a broad field of application where systems operate on a higher voltage range at lower currents. Such conditions are found in power plant and substation installations. In this installation, for instance, this type of joining was applied very successfully in the primary and secondary busbars installed in the substations that supplied this industrial plant.

It seems inevitable that joining of busbars by the low-temperature brazing alloy method will grow rapidly when its possibilities are more generally understood, and its application

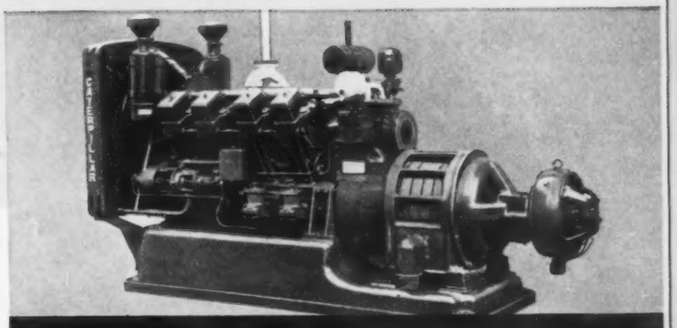
Emergencies



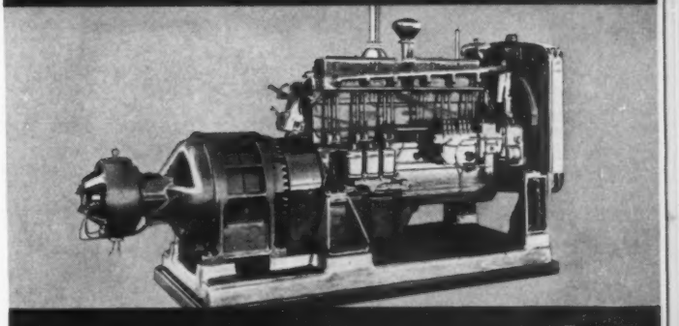
Peak Loads



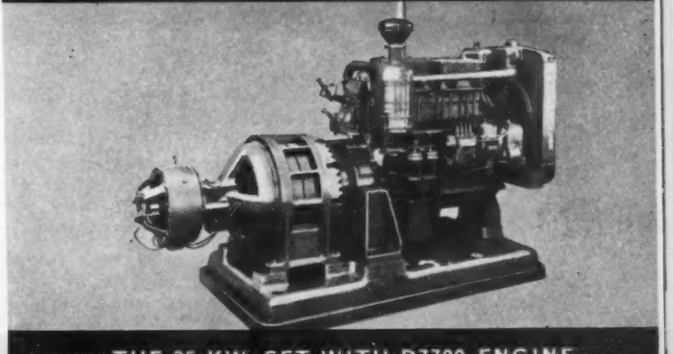
New Communities



THE 80-KW. SET WITH D17000 ENGINE



THE 50-KW. SET WITH D11000 ENGINE



THE 35-KW. SET WITH D7700 ENGINE

PUBLIC SENTIMENT swings with weather-vane delicacy. . . . It is as quick to commend a thoughtful utility service as it is to condemn neglect or indifference. Averting a serious production interruption in a factory, or meeting a lighting emergency at some hospital by rushing an independent current-generating plant to the scene — that is a service that earns good-will of incalculable value.

To give some budding outlying community current service before power-line extension is profitable, by temporarily installing and operating a Diesel-driven generator-set — that is a service which will win a profitable reward in the future.

To be prepared with stand-by generator sets for extra-load demands on main-plant equipment is far-sightedness of the shrewdest kind.

To provide for these and other contingencies through the choosing of "Caterpillar" Diesel Generator Sets is to have available the most dependable and economical auxiliary-plants on the market. Any "Caterpillar" dealer will readily co-operate in meeting any utility's needs to take advantage of such opportunities. Or, write direct to us.

SEVEN ENGINE-GENERATOR SIZES

D-17000 . . . 80 kw.	D-11000 . . . 50 kw.	D-6600 . . . 30 kw.
D-13000 . . . 60 kw.	D-8800 . . . 40 kw.	D-4400 . . . 20 kw.
	D-7700 . . . 35 kw.	

CATERPILLAR DIESEL ENGINES

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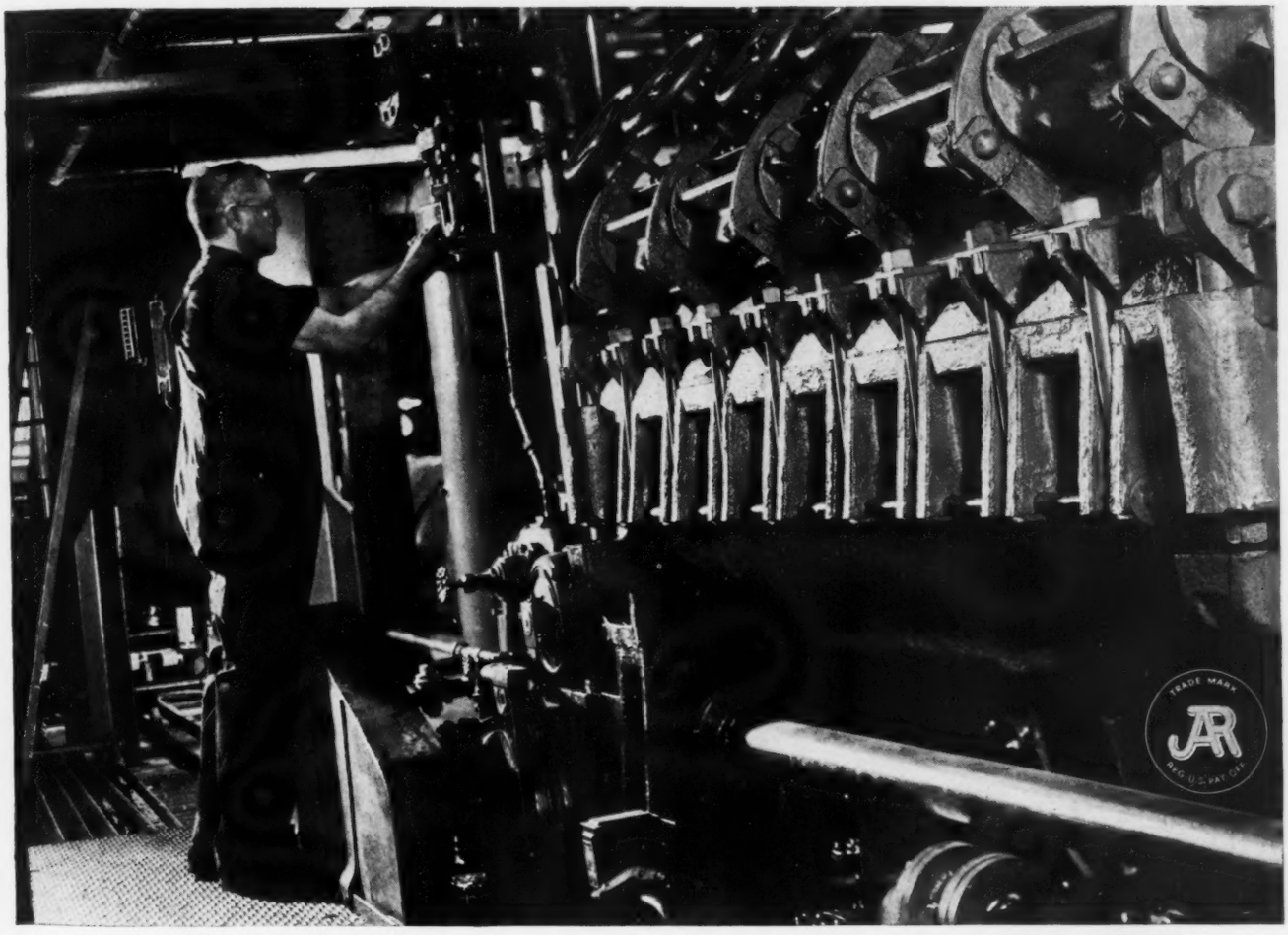
CATERPILLAR TRACTOR CO., PEORIA, ILL. . . . WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES

Cable Oil is degasified, dehumidified and decarburized here

FOR ROEBLING PAPER INSULATED CABLE



SHOWN is the modern equipment which purifies all oil used for impregnating Roebling Paper-insulated Cables. It is typical of the close control under which this power cable is manufactured to assure the utmost in quality and uniformity.

Roebling Type H Impregnated Paper Insulated Cables with graded insulation are made in Single and Multiple Conductor constructions.

We invite your inquiry regarding this cable or any of the more than 60 other types of wire and cable available.

JOHN A. ROEBLING'S SONS CO.
TRENTON, N.J. *Branches in Principal Cities*

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

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ECONOMICALLY

Highway
BODIES

Offer Comfort to the Crew . . .
Are Convenient in Arrangement . .
Are Light Weight Yet Rugged . . .
Dependable Every Mile of the Way

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DESIGNED ESPECIALLY
for
Utility Service

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Highway makes a complete line of bodies for Central Station line construction and service trucks. Standard equipment includes Highway Winches, Derricks, Tools, Racks, etc. Send for descriptive literature.

HIGHWAY TRAILER CO.
EDGERTON WISCONSIN

to electrical uses is just one more indication showing the interdependence of industry and how the results of research in basic problems in fields other than the electrical may open up new opportunities in specific industries, making available methods having broad commercial possibilities.

•

Propose Municipal Plants for South American Towns

A bill introduced in the Chamber of Representatives in Colombia, South America, and passed in first reading would impose on municipal councils of municipalities of 30,000 or less the responsibility of providing their communities with electric plants for supplying electric light and industrial power.

As reported by the U. S. Department of Commerce, the national and departmental government would co-operate in this project by making grants in aid to the extent of 50 per cent and 25 per cent respectively of the cost of constructing or enlarging municipal electric plants, such aid not to exceed 20,000 pesos ($11,400) for construction of new plants. According to a statement accompanying the bill, there are 807 municipalities in Colombia, of which only 430 have electric services at all.

•

Welsh Power Plant Expands

Work has begun at the Upper Boat station of the South Wales Electrical Power Company (England) on plant extensions to cost $2,250,000 (£450,000). Growing demand for power supplies by firms operating on the new government-aided trading estate adjoining the station are said to be partly responsible for the expansion.

•

Belgium Output Gains 33%

Electrical output in Belgium for the first six months of 1937 totaled 2,729,673,000 kw.-hr., as against 2,056,477,000 kw.-hr. for the corresponding perod of 1936, according to a report of the U. S. Department of Commerce.

•

Sponsors Football Program

Wisconsin Public Service Corporation is sponsoring a fifteen-minute football revue each Saturday at 5.40 p.m., central standard time, over WHBL, Sheboygan, Wis., for the fifth consecutive year.

and quickly removed whenever lamps need to be changed. With exterior lighting, it is claimed that there is no heat from the lamp inside the instrument, permitting use of metal dials.

•

Welding Helmet

With this new chrome leather welding helmet, designed for electric welding in tight places where the conventional type of shield requires too much space, the operator merely

"Ipco"; adjustable to various head sizes; two shades of glass: one for operations up to 200 amp., other for operations over 200 amp. **Industrial Products Co.,** Philadelphia.

raises the flip-front to inspect the weld, instead of lifting the entire shield. The outer section of the plastic composition glass holder uses Willson Weld and clear cover glass; clear glass in the stationary section of the holder protects the eyes from foreign particles when wire brushing and cleaning is done on the weld.

•

Industrial Truck

This new industrial electric truck is of the four wheel steer type, with steering control of horizontal lever or tiller bar,

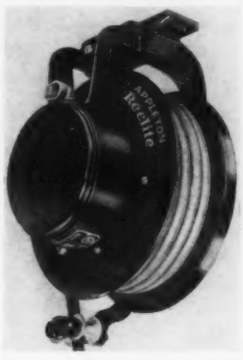
"Model A-1015-1; capacity, 4,000 lb., load platform, 72 in. long, 41 in. wide, 11 in. high; 6,000 lb. truck also in new line. **Mercury Mfg. Co.,** Chicago.

although vertical lever or wheel type steering mechanism can be furnished. The travel control is the company's snap-action, mechanical contractor type, providing three speeds in either direction. Frame construction is of all-welded type.

•

Cable Retriever

Designed particularly to supply current for fractional-horsepower motors mounted on moving carriages, and for other equipment applications in which the source of power and its use move with respect to each other, this cable retriever includes a cable-outlet guide which can be adjusted to permit any type of mounting. Electrical connections are made in terminal box on one side of reel and are brought out through a conduit connection at top of box.

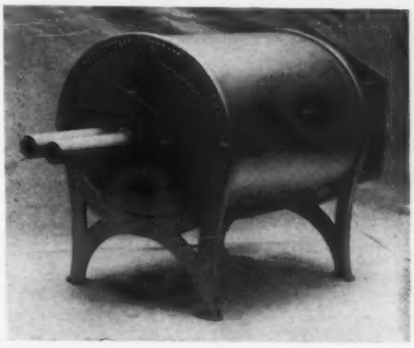


"Type R Reelite" cable retriever, current-carrying rating, 20 amp. at 600 volts; handles 25 ft. of 2, 3 or 4-conductor cable. **Appleton Electric Co.,** Chicago.

•

Combustion Furnaces

To its recently re-designed line of Model "V" high temperature tube combustion furnaces, this company adds a new type.



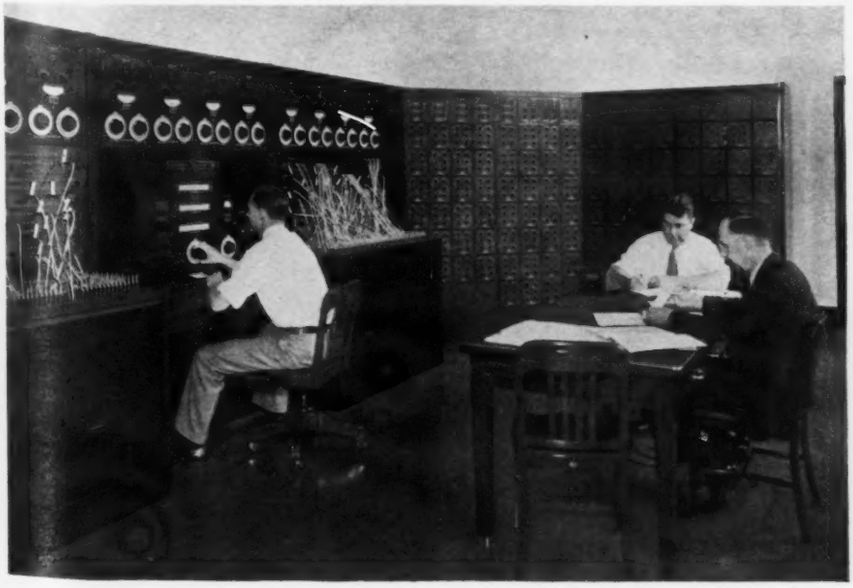
Dual tube type furnace shown; both types with air-cooled terminals, for temperatures between 700 and 1,400 deg. C.; for 110 volts, a.c. or d.c., for 220 volts with transformer on single-tube model. Maximum demand, 2½ kw. **The Sentry Co.,** Foxboro, Mass.

New tube sizes have been added to the single-tube model, terminal mounting was re-designed and better insulation provided. A dual tube model is a new type, has four heating elements installed parallel to the tubes, instead of two as in the one-tube type. Both furnaces are suggested for laboratory use, in making carbon determination of steel and ferrous alloys, combustion analyzes of products produced by oil, chemical and fertilizer companies.

•

A.C. Network Analyzer

Networks representing lines and equipment of a utility company's system may be simulated on this new and improved a.c. network analyzer. It can be operated by one man and used for load and voltage-regulation studies, investigations in system stability and network studies involving mutual reactance. Setups may be made on the board for complicated equivalent circuits as well as short-circuit and relay conditions where greater accuracy is desired than is provided by d.c. calculating tables. A central metering and main control cabinet, two centrally-located plugging cabinets and eight cabinets containing the various impedances used in setting up the network make up the analyzer. Power source is a 480-cycle motor-generator set.



480-cycle a.c. network analyzer, showing operator at centralized metering system and circuit unit cabinets at right end; dead front type panels, light-beam type master instruments. **General Electric Co.,** Schenectady.

Pole Support

A pole reenforcement which may be used repeatedly, prevents snapping of poles at the ground line and may be quickly installed

Malleable iron pole support; in three sizes and weights. **Eastern Malleable Iron Co.,** Naugatuck, Conn.

is a current offering. Device consists of a malleable iron stake support about six feet long which fits snugly against the pole body and is bound to it by a steel band or clamped with steel clamps. Total overall length is five feet six inches, about four feet of the support are hammer-driven below ground surface.

New EQUIPMENT AVAILABLE

Dust-Tight Capacitors

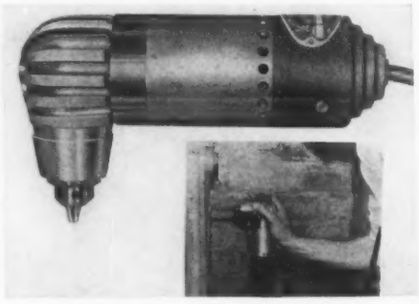
Developed for use in mills and plants with dust laden atmospheres, a new line of capacitors consist of three parts: capacitor unit proper, dust tight terminal compartment and mounting supports. Capacitor unit is of the "Inerteen" type in a heavy-welded sheet steel case with rugged porcelain terminals mounted into the case by the company's solder sealed process, whereby a bond is made between case and porcelain through medium of metalized platinum coating on the porcelain. Terminal enclosure contains boric acid fuses and discharge resistors.

Units available in 5 and 7.5 kva., 230 volt, 60 cycle ratings, and in 5, 10 and 15 kva., 460 and 575 volt ratings. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh.

•

Electric Drill

Chuck spindle of this new electric drill is mounted at right angles to the motor, reducing the overall working length of the tool to 4½ in. Motor housing dimensions have also been reduced, so that the tool will fit snugly in the operator's hand and requires no extra handle. Deep vents cast in the gear head provide for free passage of the air, and the tapered end of the gear head extends over the chuck, to protect the operator's fingers.

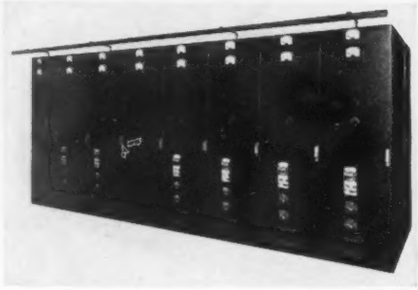


"Shorty"; in 3/16 and ¼ in. sizes; universal motor for a.c. or d.c.; standard voltage 110, also for 220 and 250 volts. **Black & Becker Mfg. Co.**, Towson, Md.

•

Metal-Clad Switchgear

The front of this eight unit metal-clad switchgear is illuminated by a streamlined lighting fixture. Oil circuit breakers, instrument transformers and insulated buses are enclosed in the satin-enamel finished, die-formed, safety steel enclosures. Switchgear is of the vertical-lift type in which the circuit breakers are removed and inserted by means of a truck.



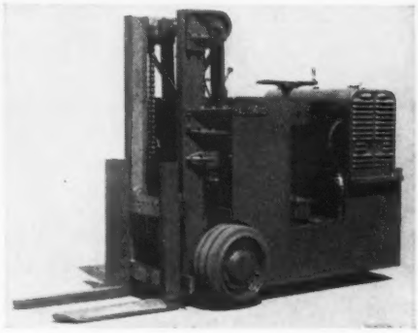
Metal-clad switchgear; 7.5 kc.; with rectangular instruments, meters and relays. **Delta-Star Electric Co.**, Chicago.

•

Industrial Truck

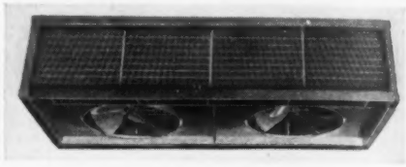
The first industrial electric truck to use the recently-developed Exide 16-cell, 13-plate battery (EW, Oct 9, 1937) will have a rated capacity of 10,000 lb., is to be used chiefly for the handling of reels of wire, ranging from 30 in. reels to 78 in. reels. It will be equipped with motorized front forks which afford rapid adjustment to suit the various sizes of reels. Tilting uprights will assure safe transportation of the reels. Front wheel drive and center control will also be featured.

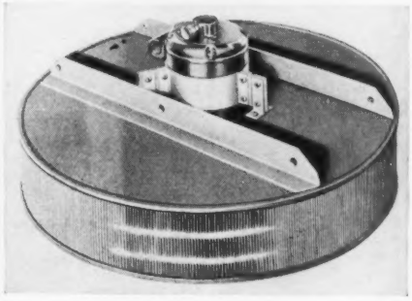
Model "THTF"; model using new battery designated "THTF-M Non-Telescoping". **Automatic Transportation Co.**, Chicago.



Projection Heaters

Two new propeller-type, projection heaters are recent additions to this company's unit heater line. Both are ceiling-mounted; in both, the warm upper air is drawn in through the two-row coils and then projected downward to the floor by the company's new four-blade propeller fan. The motors are mounted out of the path of the air, on a three-point resilient construction. In the multiple-unit type, each fan is under individual control.



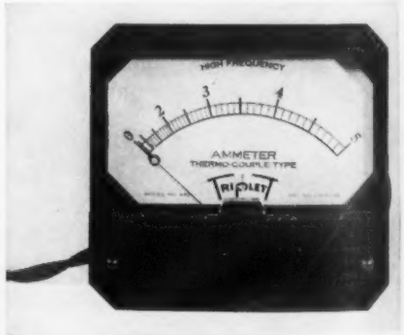


"Multiple Projection Unit Heater", above; two, three or more fans. "Projection Heater", below. **The Trane Co., La Crosse, Wis.**

•

Ammeter Illumination

Front illumination is provided for this company's instruments by molded shields which fit snugly over the lower front of the cases. Current for the 6.3-volt lamp is obtained through the screws holding the case to the panel. Shield may be easily



Model 426 ammeter with front lighting attachment. **Triplett Electrical Instrument Co.**, Bluffton, Ohio.

Manufacturing AND MARKETS

Westinghouse Orders Show Gain in Period

Noting a falling off in the number of inquiries and the temporary postponement of some prospective purchases, A. W. Robertson, president of Westinghouse Electric & Manufacturing Company, last week announced that orders booked for the first nine months this year totaled $191,200,758, as against $134,148,358 in the same period last year, an increase of 43 per cent.

For the year ended September 30, orders were $239,573,704, as against $162,295,156 in the preceding year, a gain of 48 per cent.

"Incoming orders continue at a fair level, although below the peak of the year," Mr. Robertson said. "There is some reduction in inquiries and in a few cases prospective purchases have been postponed temporarily.

"The company has a substantial backlog of orders on its books, but these are not evenly distributed; some departments are still working at capacity, while others are experiencing a letdown. Employment and production are being maintained at a high rate."

Directors declared a dividend of $1 a share, payable November 30 to common and preferred stockholders of record November 9. This is the fourth dividend declared this year, bringing the total to $4 a share.

Sales billed for the first nine months totaled $154,839,997, as against $115,992,637 in the same 1936 period, a gain of 33 per cent. Billings for the year ended September 30 totaled $193,316,391, as against $146,561,629 in the preceding year, an increase of 32 per cent.

Unfilled orders as of September 30 were $78,155,632, as against $40,605,205 a year ago.

Net income for the first nine months was $16,726,520, as against $11,123,706 in the same 1936 period. Net income for the year ended September 30 was $20,702,105, as against $14,284,446 in the preceding year.

•

Exports of Electric Appliances Increase

Exports of electrical household appliances, including shipments to Hawaii and Puerto Rico, amounted to $609,594 for August, 1937, as compared with $538,553 for July, 1937, according to reports by the Bureau of Foreign and Domestic Commerce.

Shipments of electric washing machines were 6,073 units, valued at $238,892 in August, as against 4,193 units, valued at $168,995, in July. Domestic vacuum cleaners totaled 2,431 units, valued at $45,530, as against 2,437 units, valued at $44,437.

Units and values of other major items exported during August, 1937, as compared with July, 1937 are: Flatirons, 20,508, $34,969 against 24,810, $43,195; cooking ranges, 1,113, $82,535, against 1,383, $48,954; domestic electrical heaters and ovens. 2,285, $22,387 against 3,449, $22,442; clocks, 12,881, $23,897, against 21,721, $45,886.

•

Predict Tremendous Volume for Air-Conditioning Industry

Within ten years the air-conditioning industry will do an annual volume of business in excess of $350,000,000, or seven times the total business of last year, according to George W. Mason, president of Nash-Kelvinator Corporation.

Mr. Mason stated that some $60,000,000 worth of air-conditioning equipment had been sold by American companies in the first half of 1937, 20 per cent more than for the entire year 1936.

Washer Shipments Up Sharply for 9 Months

Household washer shipments in the first nine months this year were greater than in any whole year in the industry's history with the single exception of 1936, according to J. R. Bohnen, secretary of the American Washing Machine Manufacturers' Association.

Shipments for the nine months totaled 1,394,755, compared with 1,379,062 in the three quarters of 1936 and 1,729,135 for that full year.

"Washers retailing at $70 or more were 41.5 per cent of all January-September shipments this year, aggregating 579,773, against 429,587, or 31.1 per cent of the total, in the same period of 1936," Mr. Bohnen said. Increase also was shown in household ironer shipments, the nine months' total being 147,683, as against 136,413 in the same 1936 period.

•

Manufacturers Issue Earnings Statements

The following electrical manufacturing companies have recently issued earnings statements:

JOHNS-MANVILLE—And subsidiary companies, nine months ended September 30: Consolidated net profits, $4,592,191 after all charges, including provision for depreciation, depletion and income tax accrual, but before provision for surtax on undistributed income. This was equivalent, after preferred dividends, to $4.94 a share on the 850,000 shares of common stock outstanding at the close of the period. It represents an increase of $1,498,630 compared to earnings of $3,093,561 in the first nine months of 1936, equal to $3.16 a share on the present capitalization. Sales during the first nine months of this year aggregated $46,188,836 or a gain of 33 per cent over sales of $34,733,034 in the comparable 1936 period. The consolidated net profit for the third quarter was shown as $1,780,857 or $1.94 a common share after allowing for preferred dividends. Net profit in the September quarter, 1936, was $1,618,659 or $1.75 a share on the same basis.

MCGRAW ELECTRIC—Twelve months to

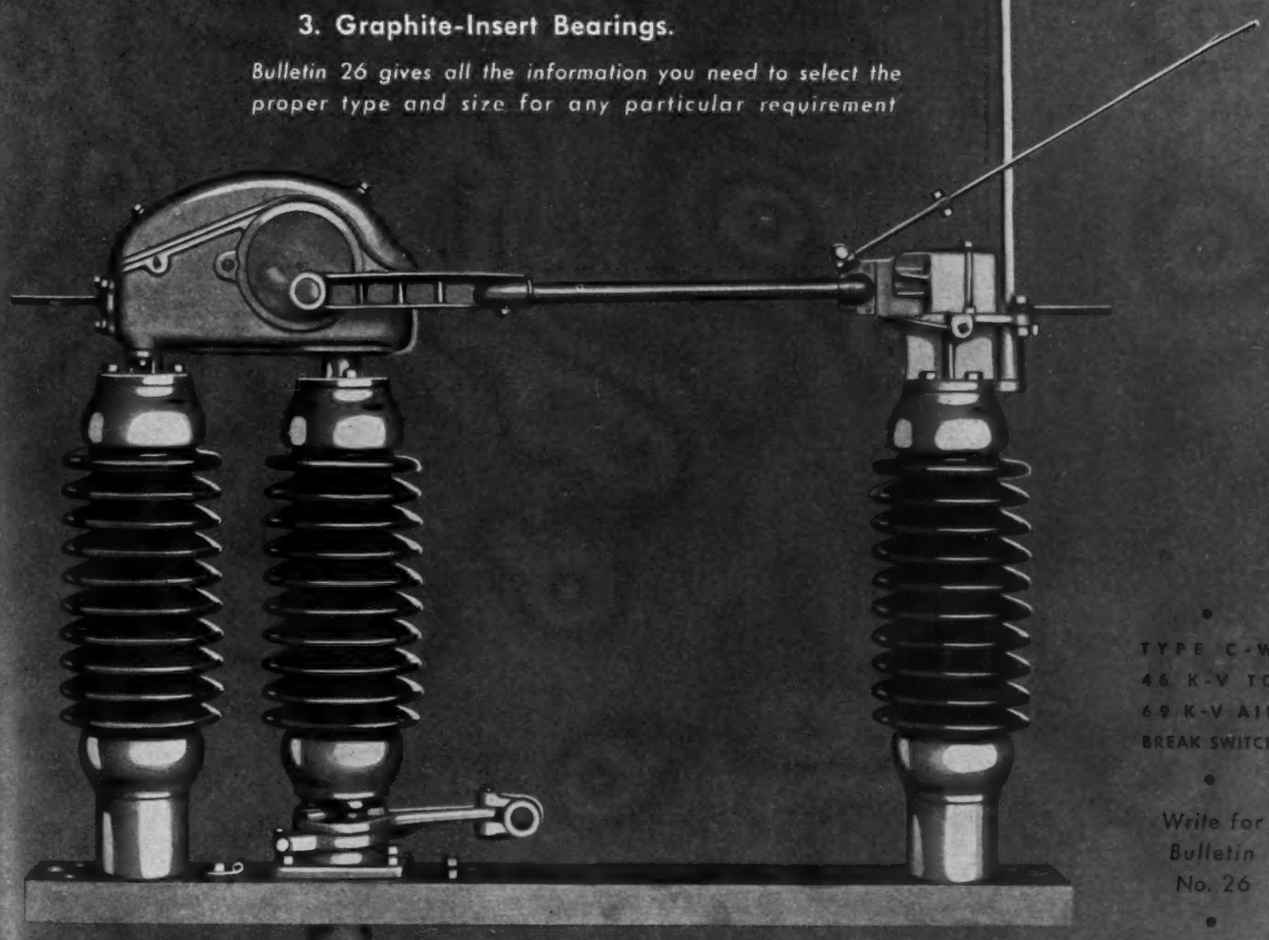
"IT'S ALWAYS FAIR WEATHER"

. . . so far as HI-VOLTAGE is concerned

• Other air-break switches give dependable service under most conditions but only HI-VOLTAGE can go the whole distance. • • • Dependable service under *any* weather conditions—for a practically unlimited period of time—is *assured* by:

1. **Totally enclosed, all-bronze, accurately machined, operating mechanism.**
2. **Monel Ball Bearings.**
3. **Graphite-Insert Bearings.**

Bulletin 26 gives all the information you need to select the proper type and size for any particular requirement



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TYPE C-W
46 K-V TO
69 K-V AIR
BREAK SWITCH

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Write for Bulletin No. 26

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HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH STREET • CLEVELAND, OHIO

September 30: Net profit, $1,242,041, equal to $2.62 each on 472,600 capital shares. This showing, the best for any twelve-month period in the history of company, compares with net profit of $874,613, or $1.84 a share in corresponding period of previous year. Net sales increased to $6,455,151, from $4,758,988 in the preceding twelve months.

•

Manufacturers Make Sales Assignments

The following assignments have been made by electrical manufacturing companies to their sales staffs:

Changes involving both headquarters and district organizations of General Electric appliance and merchandise department have been announced by R. J. Cordiner, general manager of appliance sales, as follows: C. R. Thorson, has relinquished his responsibilities as district appliance sales manager at Minneapolis to become sales manager of the electric clock section, Bridgeport. T. B. Allen, formerly district appliance sales manager at Atlanta, has succeeded Mr. Thorson at Minneapolis and J. M. Walker, formerly general sales manager of Rex Cole, Inc., New York, has been appointed district appliance sales manager at Atlanta.

Steel and Tubes, Inc., announces the appointment of Herbert H. Benfield as manager of conduit sales, Cleveland, following seven years as district sales manager in San Francisco. Arthur D. Grove has become district representative in northern California and Nevada, with headquarters in San Francisco.

•

Bids for Cable Asked

Electric Supply Department, Newcastle, New South Wales, Australia, will receive bids until November 22 for 78,540 ft. of paper-insulated, lead-covered, single-wire armored cable, for working pressure of 11,000 volts, and for pilot cables as per specifications on file.

•

Gets Government Contracts

Three government supply contracts were awarded in the week ended October 21 under the terms of the Public Contracts Act to the General Electric Company, the Department of Labor has announced: Department of Interior, transformers, $701,992; TVA, transformers, $61,050, and Treasury Department, electrical apparatus, approximately $21,659.

New York Metal Prices

	Oct. 27, 1937 Cents per Pound	Nov. 1, 1937 Cents per Pound
Copper electrolytic	12.00*	11.75*
Lead Am. S. & R. price	5.50	5.50
Antimony	17.25	17.25
Nickel ingot	35.00	35.00
Zinc spot	6.10	6.10
Tin Straits	48.50	47.625
Aluminum, 99 per cent	20.00	20.00

* Delivered Connecticut Valley.

Field Reports on Business

The recession in industrial activity has made business spotty in many lines. The upward trend in security prices, after the recent collapse, is making for a brighter outlook for late fall and holiday trade. Some price cutting has been noted, but opinion is expressed that this move should revive forward buying.

NEW YORK

The rebound in security prices, regaining a large portion of the losses in the recent break, has resulted in a better feeling in business. Gloom, which was so thick last week, is clearing with the prospects that many buyers of equipment are expected back in the market in the near future.

The caution which buyers are expressing in their orders is said to be a normal reaction when security prices tumble. However, it is pointed out that as security prices begin to tend upward, equipment and other orders generally follow.

One of the favorable factors bearing on future industrial activity is the present low state, in many lines, of stock on shelves. The belief was expressed that any sizable public buying, a prelude to the holiday trade, would bring about a rush of orders to manufacturers. This is being looked forward to as an indication as to the size of spring trade.

The small amount of price snipping which has become evident of late is considered by many as a good sign, in that a readjustment of prices, especially in the building trades, would stimulate construction. There are no signs as yet that there will be any great curtailment of present utility construction. The main factor now holding up work, it is said, is the raising of new capital. The collapse in the securities markets has about shut out utility financing, temporarily at least. Electrical trade reports indicate good activity, with appliances still in demand. Inquiries and the attendance at the automobile show here indicate that there is still a lot of consumer buying power available.

PACIFIC COAST

While wholesalers report a rather disappointing October, their sales held up fairly well, but did not increase consistently with the season. Government prospective business is excellent, with such highlights as an electrical contract for a $1,500,000 Sacramento air base building, $1,000,000 Hickham Field officers' quarters in Hawaiian Islands and assurance that a $13,500,000 Alameda air base will be begun by December.

Considerable "downtown" building is reported, with three San Francisco remodeling jobs averaging $350,000 each and skyscraper apartments for San Francisco and Long Beach. A $10,000,000 state prison is scheduled for 1940 completion, with first unit now under way.

Sizable orders include $50,000 motors and controls for Alaskan gold dredge, $55,000 for an electric locomotive with charging equipment and batteries for a Utah copper mine and control and switching details for Los Angeles water district, value $35,000.

A copper price drop unexpected in its size has considerably upset coast markets and the hand-to-mouth buying which is temporarily inevitable may react upon annual inventories.

The motion picture field continues very active, with two new theaters recently begun and $500,000 worth of additions to MGM's Culver City plant, including a film laboratory and an industrial crafts center. San Francisco exposition business subscription fund is nearing completion, exhibit palaces are practically all awarded and individual exhibitors are expected to begin their booths and separate buildings.

CHICAGO

Further mild recessions occurred last week in industrial activity. Most industries maintained a level above a year ago, but the margin of improvement was materially reduced from the previous month. Retail and wholesale trade presents a more encouraging picture, holding up fairly well, in the face of marked reductions in other fields. Orders for electrical equipment are being received in good volume, but are substantially below the peak for the year. Furthermore, inquiries have declined rather rapidly and in some cases prospective purchases have been temporarily postponed.

Inquiry reveals that a large proportion of electrical manufacturers are maintaining a high rate of production and one large company reports that unfilled orders on hand are more than 50 per cent higher than a year ago. A large manufacturer of radios reports current operations with a normal force, but slightly under the peak of the previous quarter. Operations, however, are far ahead of last year.

Construction work by central stations goes forward at a steady pace. Purchases of equipment are well above a year ago and at present no indications of curtailment are apparent. Sales of apparatus in the stockyard and steel districts have fallen off as activity in those areas has shown some sizable reduction.

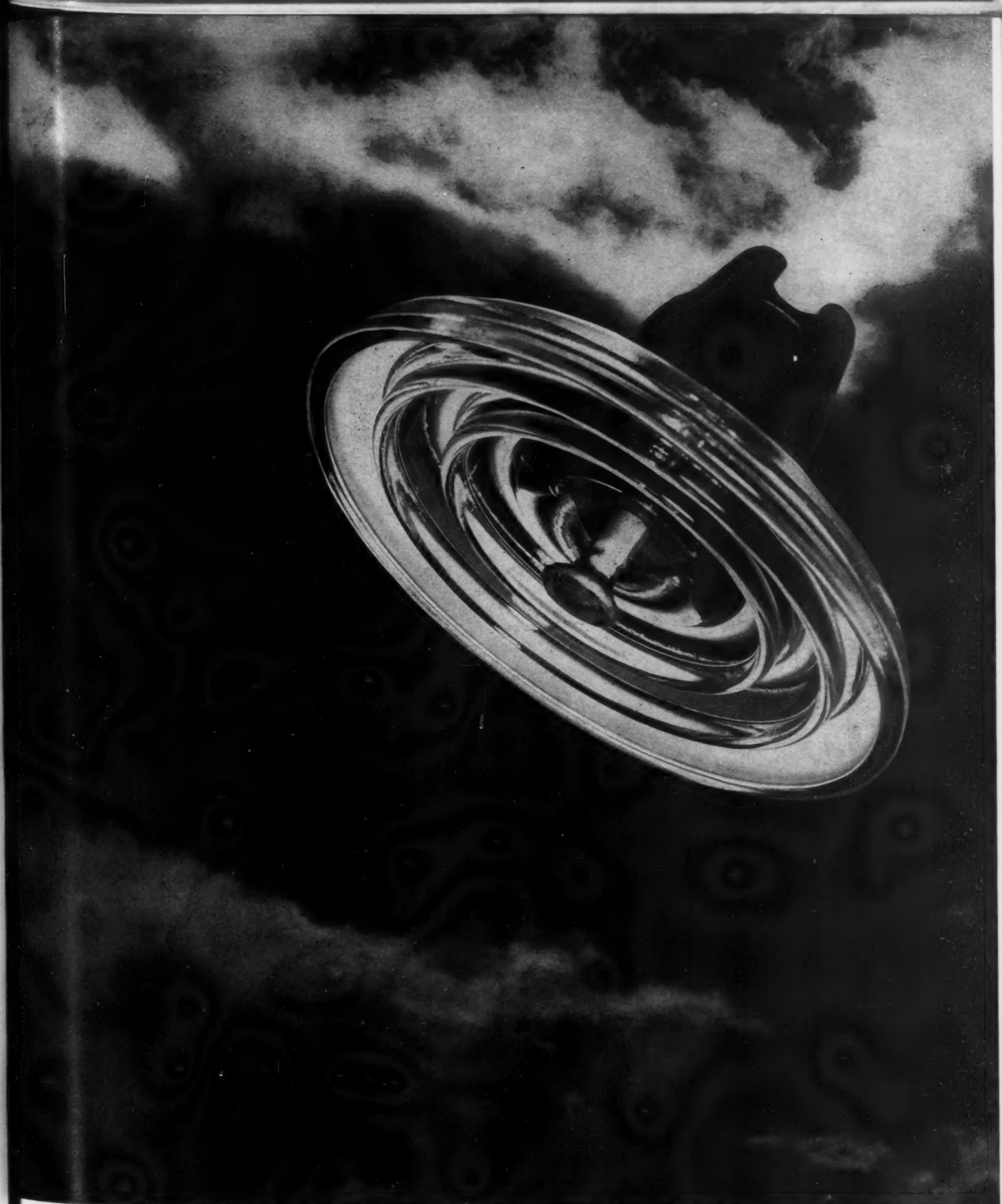
NEW ENGLAND

Business is spotty, with improving outlook for a long pull. A prominent electrical apparatus maker is running 70 per cent capacity and expects a fair business through the winter.

The shoe and textile industries are much disturbed by the Administration's encouragement of foreign competition. Acquisition of the former American Printing Company plant at Fall River by Firestone Rubber for Latex products presages electrical improvements and stimulated encouragement in industrial circles. The market recovery last week helped business sentiment, with evidence of sobering effect on labor and political factors throughout the country.

Motor sales continue diversified; household appliances move toward good holiday trade. Boston Edison sold 1,800 major units in the last quarter and 1,500 ranges in nine months, 47 per cent gain. Inventories of retailers of electrical appliances are down to rock bottom and new stocks will be delayed until after new refrigerator and other model showings this month.

Factory lighting equipment sales have been effected, according to one representative by the disturbance in business activity among many industries in western Massachusetts and the northern part of this district. Street lighting moves moderately, including new equipment for Haverhill at a cost of about $1,500 for additional electrically controlled traffic signals.



GREATEST RELIABILITY UNDER SUSTAINED LOADS... *another high spot in*

TODAY'S TREND TOWARD PYREX POWER INSULATORS

PYREX is a Trade Mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

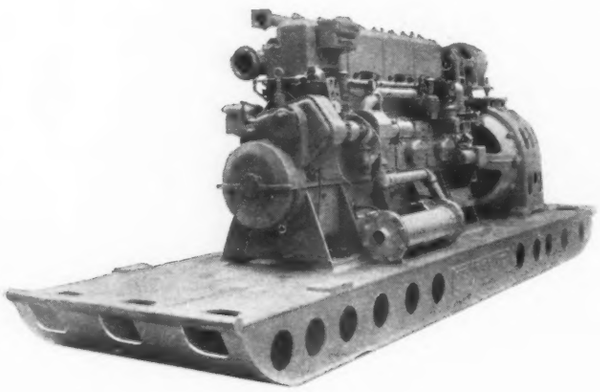
CONTINUOUS DUTY GAS ENGINES

Hold the Record for Low Cost Power

STERLING HIGH DUTY

Sterling — THE ENGINE OF REFINEMENT

INTERNAL COMBUSTION ENGINES



Semi-portable 8-cylinder 400 H.P., 900 R.P.M. Gas Engine, direct connected to 200 K.W. Electric Machinery and Manufacturing Company generator and mounted on welded steel skid for oil field power.

In the mid-continent enough gas is being wastefully burned to supply you with cheapest power. Surplus gas is being collected and distributed by pipe line, and Sterling Gas Engines are available at lowest cost, with many advantages, to utilize this fuel.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, New York

Dept. C-2

Branch Office
900 Chrysler Bldg.
New York, N. Y.

Getting a Start on the Attic Ventilation Load

[*Continued from page 63*]

134 installations were sold within the city of Shreveport.

Cost and revenue

The real measure of the promotion is its cost and the income it produced. The cost is broken down as follows:

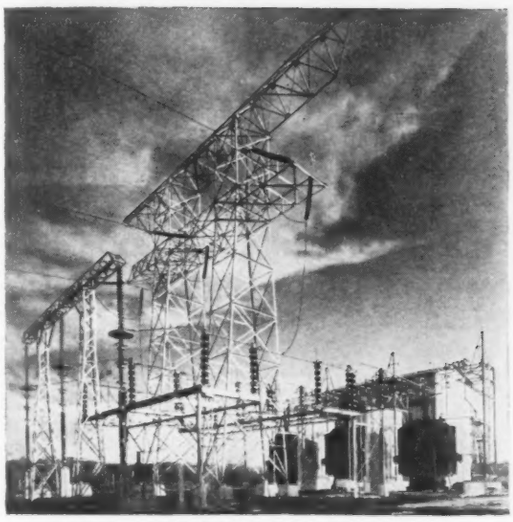
Newspaper advertising	$511.20
Booklets purchased for use in Shreveport	285.00
Radio, ½ of six weeks	208.35
	$1,004.55

For revenue determination we submetered two installations. From the data thus obtained we concluded that 1,000 hours operation per season would be reasonable. This operation of a 1/3-hp. motor at a rate step of 3 cents would result in $10 revenue. In large homes where large fans are installed with motors ranging up to ½ or possibly ¾ hp. the income will be more. In some homes that are careful about operating costs the income may be less than $10. We believe that $10 is a conservative over-all average figure.

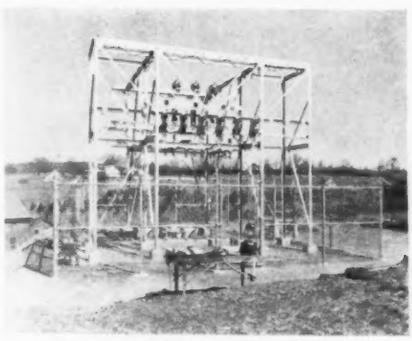
Assuming that our $10 E.A.R. figure is correct, then our income from the 134 installations made in the summer of 1936 amounts to $1,340 during the first year. Our cost was $1,004.55. This gives us a cost per dollar of E.A.R. of $0.75. We think this cost is excellent in view of our late start and the fact that we were promoting a new idea and that its promotion involved making arrangements with the dealers to get lines of equipment and to train their sales forces.

Our conclusion concerning the promotion is this: For a small sum of money we have launched a new type of load building in Shreveport. At a cost of 75 cents per dollar E.A.R. we have planted 134 installations. From these installations we expect to sell about three times that number next year. We believe that the most effective assistance we get is the word-of-mouth recommendation of satisfied users. We think the ultimate size of the market closely approaches the number of refrigerator owners who also own their homes. We have not yet formed any conclusions about rented houses. Some apartment houses will be equipped by the owners. The same may prove to be true about residences for rent, but we cannot say at this time.

Elpeco Substations are individually designed TO YOUR SPECIFICATIONS



A Complete 220 K.V. Substation



Just a 15 K.V. Substation

We make 'em

LARGE

•

We make 'em

SMALL

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BUT! by skillful design we obtain **MAXIMUM** strength at **MINIMUM** weight.

That's **ELPECO**

Ask for Questionnaire Form . . . it will save us BOTH time and insure a thorough UNDERSTANDING of YOUR PROBLEM.

ELECTRIC POWER EQUIPMENT CORPORATION

412 North 18th St. Philadelphia, Pa.

MICABOND

the only insulation for some . . . the best insulation for many purposes

Micabond combines the good qualities of raw mica with adaptability. It is mica in its most usable form — insulation that should be specified wherever maximum dielectric strength is needed in equipment subject to high operating temperatures.

Let us help you select Micabond in correct grade, form and strength for your requirements. Perhaps it might be economical to have us supply your fabricated parts, ready for assembly, a service some Micabond users find most advantageous. Ask for details.

CONTINENTAL-DIAMOND FIBRE COMPANY
NEWARK, DELAWARE
Represented in Canada by
DIAMOND STATE FIBRE CO. of Canada, Ltd., Toronto

MOLDING PLATE **HEATER PLATE**
SEGMENT PLATE **FLEXIBLE SHEETS**
TAPE-TUBING

FABRICATED PARTS SUCH AS "V" RINGS, SEGMENTS AND WASHERS

Analyze Enameling Costs of Electric vs. Fuel Furnaces

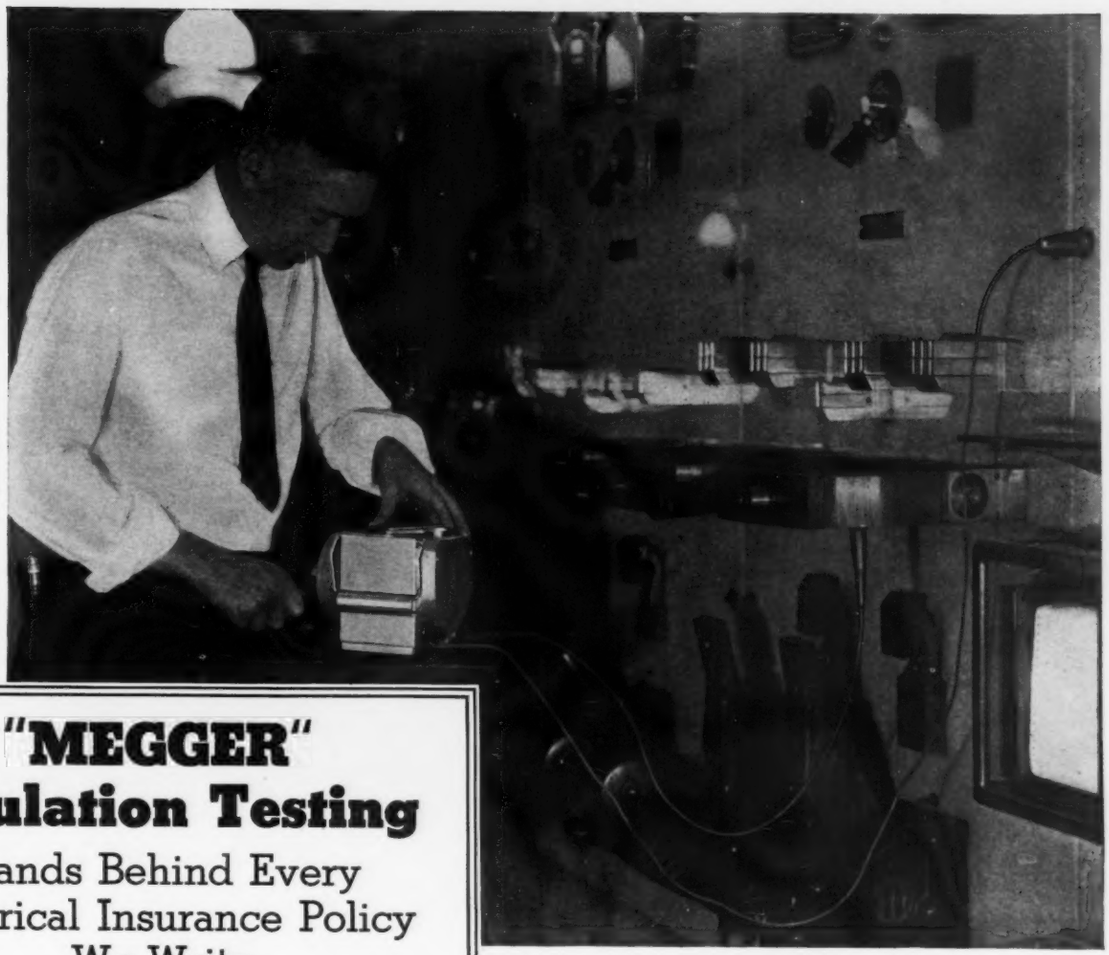
[*Continued from page 80*]

heated furnaces, respectively. In Table I, for sheet steel, and Table II, for cast iron, the annual total figures on fuel or power units consumed, firing hours, days operated and production in finished ware are presented. Also, the observed averages for fuel or power consumed per hour and for units of ware finished per hour, per unit of fuel or power and per labor hour.

In an electric furnace it is claimed that low temperature gradients and fixed uniformity in the distribution of heat input increases the average area of hearth that can be used to fire first-quality ware, thus increasing the output as compared to fuel-fired equipment. Also, it is claimed that uniform heat input, decrease in time lost for repair, elimination of slow production or half-load firing due to combustion irregularities and fewer rejects all combine to increase the productive capacity for the electric furnace. The data obtained certainly indicate that these claims can be substantiated. The electric furnace does give evidence of capacity to finish more ware per average hour and so more per labor-hour than the oil-fired muffle type furnace.

These data indicate an answer to another problem that I am sure all power salesmen have been up against. We have all figured with our prospects on a 5x12-ft. box-type electric furnace and been asked to estimate on a furnace with capacity to fire *one* coat on 600 sq.ft. of 20-gauge sheet steel per hour at 1,575 deg. F. We probably gave the prospect an estimate of 240 kw.-hr. per hour. And he had in mind his own *average* figure of 14.5 gal. per hour. With the prospect figuring in averages and we figuring *a single hour, peak load*, how could we expect to get together?

These new data can be used to help power salesmen "talk the language" of their prospects. In the accompanying curves for sheet steel and cast iron the statistical average values for oil-fired and electrically heated box-type furnaces have been plotted to show the relationship between average production of finished ware per month and the units of ware finished per unit of fuel or energy consumed. Let us assume that we are to figure on an average production of 40,000 sq.ft. of finished ware per month. The oil



"MEGGER" Insulation Testing

Stands Behind Every Electrical Insurance Policy We Write . . .

OCEAN ACCIDENT & GUARANTEE CORP.

"MEGGER"

WHEN the Ocean Accident & Guarantee Corp. entered the field of Electrical Insurance over 16 years ago, the company engineers adopted "MEGGER" TESTING (using our "Megger" Insulation Testing Instruments), as a simple and practical means of following the condition of insulation in motors, generators and other electrical equipment insured by them. They have continued this practice of testing risks before they are accepted and periodically thereafter, with the result that today "Ocean" engineers can detect insulation weaknesses with a certainty that may seem remarkable.

"Megger" Testing enables any intelligent electrical man to detect the presence of dirt and moisture in electrical equipment and to guard against inevitable deterioration. It gives protection from the danger and the cost of unexpected insulation failure and resultant shut-down. And it is significant that the operators of many plants who carry Electrical Insurance use "Megger" instruments *themselves* and cooperate with the insurance company in upholding high standards of inspection and maintenance.

Our illustrated descriptive Bulletin 1355-W will be sent on request.

JAMES G. BIDDLE CO. 1211-13 ARCH STREET PHILADELPHIA, PA.

Insulation Testing Instruments—Ground Testing Instruments—Speed Measuring Instruments—Frequency Meters

Reliable

STRAIGHTLINE SPLICES

FOR

TYPE A COPPERWELD WIRE

•

Specially designed and built to consistently hold approximately the full strength of type A Conductors.

The Reliable Straightline Splices for Copperweld composite cable are equipped with jaws which grip the wire over a long enough surface to insure consistent holding of this three strand wire with its long lay. These splices retain the outstanding features pioneered in the standard Straightline Splices.

A husky washer maintains the jaws in perfect alignment equally spaced around the wire and eliminates the danger of a strand jamming between jaws and causing trouble.

The ends are tapered to fit the wire closely preventing insertion of improperly prepared wires. This shape also dampens vibrations before they reach the clamping jaws, and it permits pulling over crossarms without catching.

The gripping power of this splice is so great that under test it breaks the wire at approximately its full strength. It makes a good electrical joint, and it is positive in operation.

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Reliable ELECTRIC COMPANY

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furnace would average about 4.9 sq.ft. per gallon of oil and the electric furnace about 0.68 sq.ft. per kilowatt-hour. Thus we find that the oil-fired furnace may be estimated to consume about 8,200 gal. and the electric furnace about 58,800 kw.-hr. per month. If oil, as a material used in the heating process, costs 5.5 cents per gallon, the oil bill for the month would be about $451. If furnace power is billed at 1 cent per kilowatt-hour the electric bill for the month would be about $588. What a difference! Using the "conventional rating" method, we would have been comparing 18 gal. per hour, or $0.99 per hour, with 240 kw.-hr. per hour, or $2.40 per hour. Then the error of reasoning would have been magnified by assuming 200 hours' use of the furnace per month to give an oil bill of $198 and an electric bill of $480.

Table III—Comparison of Cost Items in Terms of Percentage of Manufacturing Cost

	Annual Totals	
Oil-Fired Furnaces		
Sq. Ft. Sheet Steel Produced	Oil and Auxiliary Power Costs Per Cent	Direct Labor Costs Per Cent
632,051	12.9	40.6
Pounds of Cast Iron Produced		
3,755,910	10.8	39.1
Electrically Heated Furnaces		
Sq. Ft. Sheet Steel Produced	Furnace and Auxiliary Power Costs Per Cent	Direct Labor Costs Per Cent
633,336	16.9	34 3
Pounds of Cast Iron Produced		
3,782,786	14.3	30.8

The total manufacturing cost for the oil-fired furnace plants averaged 13.6 per cent higher than the total cost with electrically heated furnaces.

Also, examine the cost data afforded by the operating records of these enameling plants. In Table III is presented, in terms of percentage of manufacturing cost, the cost of oil plus the cost of auxiliary power (for motors, lighting, etc.) and the cost of furnace power plus the cost of auxiliary power as one item for the respective types of furnaces; then the cost of direct labor for firing the ware as the other item. On the basis of these data it is shown that when firing sheet steel the use of electrical furnaces increases heating costs 4 per cent, but reduces labor costs 6.3 per

FOR HEAVY DUTY SERVICE SUCH AS THIS MILL DRIVE EQUIPMENT

Use "SA" Series Brushes

They possess the necessary stamina to withstand severe peak loads and emergency demands.

They have set new standards of uniformity in performance as well as in physical properties.

They improve commutation under difficult conditions.

They Reduce Operating And Maintenance Expense.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide UCC and Carbon Corporation

Carbon Sales Division: Cleveland, Ohio General Offices: 30 East 42nd Street, New York, N.Y.

BRANCH OFFICES: NEW YORK PITTSBURGH CHICAGO SAN FRANCISCO

DIXIE
dense Long-Leaf
YELLOW PINE
POLES *invite comparison for*

STRENGTH—by laboratory or field test
RIGIDITY—all lengths and classes
PENETRATION—by pressure treatment
DEPENDABILITY—Quality and Grade
COST—per years of service

JACKSON LUMBER COMPANY
LOCKHART, ALABAMA
A CROSSETT WATZEK GATES INDUSTRY

cent, while when firing cast iron the electric furnaces increase heating costs 3.5 per cent but reduce labor costs 8.3 per cent. Then the over-all cost figures show a saving from all items of 13.6 per cent.

Such averages may be affected by different methods of accounting, different burden charges, etc. For this reason one plant was selected which was using both the electrically heated and the oil-fired muffle furnace in the same department, feeling that the strongest evidence of the cost advantage with electric furnaces would be obtained there. In Table IV are shown the average figures for the oil-fired and the electrically heated furnaces, respectively, covering a month of approximately equal production to make the data comparable. These figures show that although the cost item for furnace and auxiliary power increased 18 per cent over the oil furnace cost for oil and auxiliary power (*i.e.*, from 10.7 to 15.3 per cent of production cost) the cost of materials dropped 33 per cent, the cost of direct labor dropped 31 per cent and the cost of maintenance dropped 29 per cent (*i.e.*, for an increase of 4.6 per cent, a saving of 15.8 per cent in these items was made). It is found that the total effect of both tangible and intangible savings are shown by the fact that the over-all costs totaled 17.2 per cent lower with electric heat. This is a strong indication of the reality of every advantage claimed for the electrically heated furnace.

Table IV—Comparison of Cost Items from One Plant in Terms of Percentage of Manufacturing Cost

Oil-Fired Furnaces

Sq. Ft. Sheet Steel Produced (One Month)	Material Cost Per Cent	Oil and Auxiliary PowerCost Per Cent	Direct Labor Cost Per Cent	Maintenance Item Cost Per Cent
52,224 Pounds of Cast Iron Produced	35.7	11.9	46.5	6.45
359,228	34.6	9.9	42.5	

Electrically Heated Furnaces

Sq. Ft. Sheet Steel Produced (One Month)	Material Cost Per Cent	Furnace Power and Auxiliary Power Cost Per Cent	Direct Labor Cost Per Cent	Maintenance Item Cost Per Cent
52,777.76 Pounds of Cast Iron Produced	26.8	16.9	34.3	5.55
372,048	29.2	14.3	36.6	

The total manufacturing cost for the oil-fired furnace averaged 17.2 per cent higher than the total cost with the electrically heated furnace.

Out in FRONT

Every pack of "huskies" has its leader—the dog who is in front position, not by appointment, but under the law of the survival of the fit. Likewise, in every industry there are those who lead. They hold this front position not because they claim it to be theirs, but because the field they serve has placed them there. This position cannot be attained by coaxing or by asking for it. It comes only to the manufacturer whose product has earned it—Electrical tradenames of almost priceless value daily are entrusted to the performance of heating elements made of Chromel. This sort of confidence obviously is placed only upon a product that deserves it. . . . For technical data, send for Catalog-L. . . .

HOSKINS MFG. COMPANY
DETROIT MICHIGAN

H O S K I N S

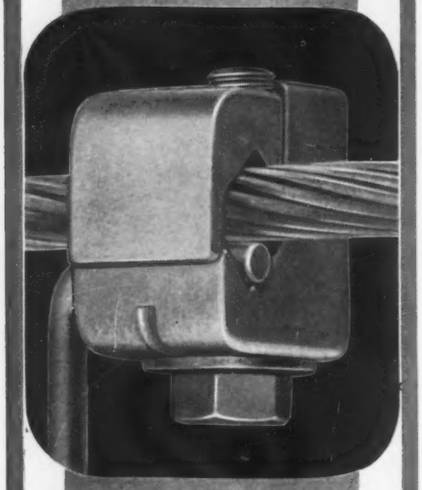
CHROMEL

THE WIRE THAT MADE Chromel ELECTRIC HEAT POSSIBLE

The

FARGO

UNIT CONNECTOR



Not a Complaint in a MILLION

● **Millions in use, yet not a single complaint during the past year is the record of Fargo Unit Connectors.**

The Fargo one-piece design has no parts to lose, is always threaded. It insures high compression at low wrench torque. Joints are high in conductivity, low in voltage drop. Jaws are vibration-proof. Built of high strength, distortion-proof copper alloy, Fargo Connectors stand repeated use.

Write to Line Material Co., South Milwaukee, Wisconsin, for full details.

Made by
Fargo Manufacturing Co.

DISTRIBUTED BY

LINE MATERIAL CO.

Recent Rate Changes

PENNSYLVANIA PUBLIC UTILITY COMMISSION has ordered the Philadelphia Electric Company to reduce its rates $3,107,000 a year. The new tariff will be for a trial period of six months from November 1, unless extended by the commission, and the rates prescribed will become permanent at the expiration of the trial period, or any extension of it, unless the company complains to the commission that they are unjust or unreasonable. The reduction goes to 625,000 customers, 90 per cent of the company's total. Domestic customers in Philadelphia, numbering 400,000, are to benefit; 155,000 domestic customers outside of Philadelphia, and 70,000 small commercial and industrial customers are also to have their rates reduced. The commission also ordered the Metropolitan Edison Company to file new tariffs, slashing $795,000 a year off its rates. Reductions, to be effective until the final outcome of the commission's investigation of the company would be split as follows: residential consumers, $407,000; commercial, $220,000; power, $158,600; municipal, $8,000, and street lighting, $2,300. The commission was asked to restrain Metropolitan Edison Company from paying common stock dividends to its parent, New York, Pennsylvania and New Jersey Utility Company, pending outcome of the commission's rate case against the utility. The motion was made by Arnold H. Hirsch, counsel for Reading Merchants Ice Company, a consumer. Counsel for the Metropolitan objected that the commission has no power to prevent the company from making whatever dividend payments it wished. Other reductions recently ordered are: Duquesne Light, $1,250,000; Edison Light & Power, York, $435,000, and Solar Electric, $11,300. A federal court decision at Scranton has restrained the commission from putting the Edison Light & Power temporary rates into effect.

PORTLAND GENERAL ELECTRIC COMPANY and the Northwestern Electric Company have revised their residential and commercial rates downward to the amount of approximately $331,000, effective with the billings after November 26. The new rates were arrived at after negotiations between N. G. Wallace, Public Utilities Commissioner of Oregon and the companies. The Washington Department of Public Service concurred as far as the Washington properties of the two companies are concerned and ordered the new rates into effect in Vancouver, Camas and Washougal. In Oregon the rates apply in Portland and surrounding cities served by Portland General Electric at Portland rates. Mr. Wallace commented that both companies had cooperated splendidly in bringing about the reduction.

OHIO PUBLIC UTILITIES COMMISSION has reported that reduced rate schedules filed by electric, gas and telephone companies saved Ohio consumers $3,547,704 during the first nine months of 1937. Of the amount, $1,912,000 was ordered by the commission and the remainder was made voluntarily by the utility companies or by negotiation or informal conference between the commission and the companies.

SOUTHERN PUBLIC SERVICE COMPANY has made a voluntary reduction in the domestic electric rate at Louisa, Ky. Under the new schedule the minimum and maximum rates of 3 and 10 cents remain the same, but users of intermediate amounts will save from ½ to 1 cent a kilowatt-hour. The same schedule was made effective at Fallsburg, where the rate had been 13 cents straight.

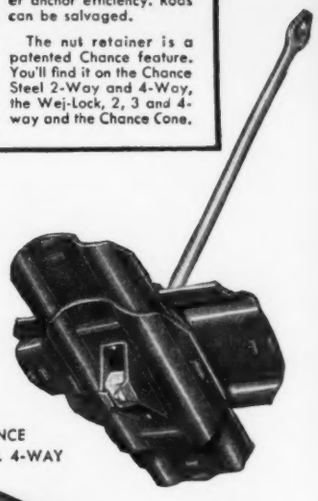
EMPIRE DISTRICT ELECTRIC COMPANY has

THE CHANCE PATENTED NUT RETAINER

Saves **TIME ENERGY MONEY**

Expanding or cone anchor installations are made easier, better, quicker, and cheaper with the Chance patented nut retainer because it prevents the anchor from riding up the rod and makes it possible to keep the hole to the minimum size, giving greater anchor efficiency. Rods can be salvaged.

The nut retainer is a patented Chance feature. You'll find it on the Chance Steel 2-Way and 4-Way, the Wej-Lock, 2, 3 and 4-way and the Chance Cone.



CHANCE
STEEL 4-WAY

WEJ-LOCK
MALLEABLE 4-WAY

CHANCE
"DURAMEL" CONE

A·B·CHANCE CO. *Utilities Division*
CENTRALIA MISSOURI

SPECIFY

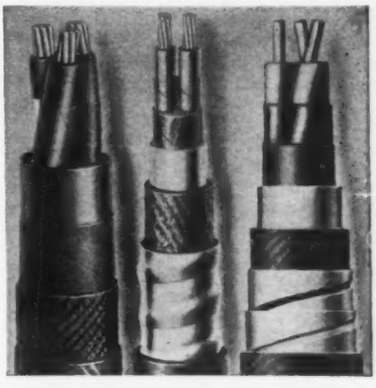
AMERSEAL
NON-METALLIC
OR
STEEL-TAPED
PARKWAY CABLES

Made by American Steel & Wire Company

"MADE by American Steel & Wire Company" means a lot to buyers of electrical wires and cables. It means absolute reliability based upon years of satisfactory service from thousands of installations.

Amerseal Non-metallic Parkway Cables are designed for direct burial in earth, without external protection. In these cables a jacket of tough vulcanized rubber, covered with a heavy layer of asphalted jute, protects the insulated conductors from mechanical injury and from action of moisture, earth acids and alkalis. This unique construction gives full protection to the cables, yet you will find them light in weight, flexible, easy to handle and extremely economical.

Our Steel-Taped Parkway Cables have rubber insulated conductors protected by a lead sheath and by one or more layers of metallic armor. Use our Armorlokt or flat steel-taped metallic cables wherever added mechanical protection is necessary. For complete information, send for our new Parkway Cable catalogue.



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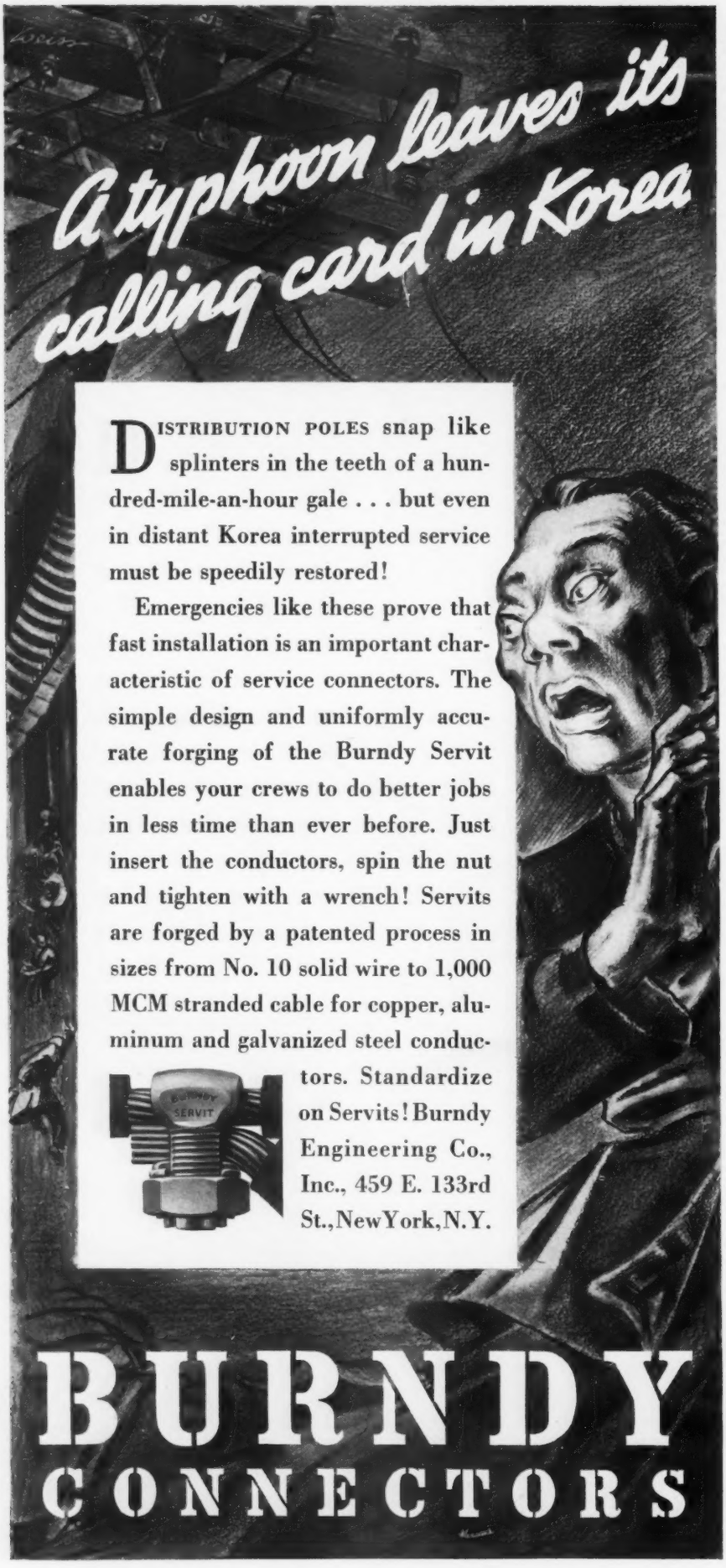
UNITED STATES STEEL


A typhoon leaves its calling card in Korea
DISTRIBUTION POLES snap like splinters in the teeth of a hundred-mile-an-hour gale . . . but even in distant Korea interrupted service must be speedily restored!
Emergencies like these prove that fast installation is an important characteristic of service connectors. The simple design and uniformly accurate forging of the Burndy Servit enables your crews to do better jobs in less time than ever before. Just insert the conductors, spin the nut and tighten with a wrench! Servits are forged by a patented process in sizes from No. 10 solid wire to 1,000 MCM stranded cable for copper, aluminum and galvanized steel conductors. Standardize on Servits! Burndy Engineering Co., Inc., 459 E. 133rd St., New York, N.Y.
SERVIT
BURNDY
CONNECTORS

revised its rate schedule applicable to lead and zinc mines where electricity is used for hoisting. It is estimated the reduction will mean an annual recurring saving to the operators of $4,000. The Kansas Corporation Commission has approved the new schedule.

OKLAHOMA ELECTRIC & WATER COMPANY has reduced electric rates at Guymon, Forgan and Beaver $3,500 a year as the result of informal negotiations with the State Corporation Commission.

SKANEATELES, N. Y., municipal electric plant has reduced its rates to save consumers an estimated $4,700 a year.

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Municipal Plants

FORT PAYNE, ALA.—City Council has passed an ordinance calling an election on November 23 to determine whether the city shall construct or acquire its own system for the sale and distribution of electric energy. The election was called in response to a petition circulated some weeks ago to try to bring TVA power to the city.

NORTHBORO, MASS.—Herbert L. Kimball is chairman of a committee appointed by Moderator R. M. Leland to proceed with a preliminary investigation and collect data in connection with a proposal to build a municipal electric light and power plant. The committee will report its findings in March, 1938.

NEWTON FALLS, OHIO—Ohio Supreme Court has dismissed appeal of the Ohio Public Service Company, which sought to enjoin the village from constructing a $150,000 municipal light plant. Village Council authorized issuance of that amount in bonds to finance the project more than a year ago. The utility company protested that its investment in a plant now serving the village would be lost and that a bond issue would pledge the general credit of the village. Lower courts upheld the village. The Supreme Court refused to hear the case on the ground that no debatable constitutional question was involved. The utility had contended that legislative proceedings were involved and that construction of the municipal plant would be a repudiation of its franchise to furnish the village with electric energy until 1941.

JACKSON, TENN.—Seeking to enjoin the city from building a municipal distribution plant for the sale of TVA power, the West Tennessee Power & Light Company has filed suit in the Federal Court in Jackson. Setting forth that pursuant to a municipal election in 1913 the city extended an exclusive contract and franchise to the power company until 1963, the bill states that the company has invested more than $150,000 in its properties in Jackson. The bill also seeks an injunction of the sale of city bonds which has been authorized to pay for the building of the plant and asks the court to declare the city's TVA contract void. The injunction was denied.

SOUTH NORFOLK, VA.—Sheridan P. Gorman, State Director of PWA, has announced a grant of $148,000 sought by the city to aid in constructing a $331,000 electric light and power plant and distribution system, has been allocated. Mr. Gorman said work on the project had been delayed by a temporary injunction obtained by the Virginia Electric & Power Company which supplies the city. Construction work is expected to start in the near future, Mr. Gorman said, inasmuch as a similar proceeding against a PWA project in Greenwood County, S. C. (Duke Power) was recently decided in favor of the county and PWA. An outright grant of $148,000 was made by PWA last Novem-

ber, but was held up by the utility injunction. The town of South Norfolk has not been officially notified of the allocation nor of any change in the status of the injunction, Charles H. Hughes, director of public works for the town, stated. R. J. Throckmorton, vice-president of Virginia Electric & Power in charge of the Norfolk division, has appeared before a special meeting of the City Council and asked permission to submit a proposition to furnish electric power to South Norfolk in lieu of the proposed municipal electric plant. Mr. Throckmorton stated that his company had developed South Norfolk and felt it has the greater claim to furnishing power and did not care to leave the field.

SHULLSBURG, WIS.—In a decision involving this village, the Wisconsin Supreme Court has upheld the right of a majority in any municipality to proceed with acquisition proceedings of public utilities, unhampered by further referendums instigated by minority opponents. The opinion reversed a temporary restraining order of Circuit Judge Sherman B. Smalley which forbade municipal officials to proceed with issuance of bonds for acquisition of a light plant until a referendum on continuing the acquisition had again been submitted to the people.

SUPERIOR, WIS.—Councilman John Green has started action in the Dane County Circuit Court against the Wisconsin Public Service Commission, the city, and the Superior Water, Light & Power Company for the purpose of vacating an order of the commission fixing the price of the Superior utility at $4,625,000, charging the price to be excessive.

•

Rate Issue Delays Allotment

Tide Water Power Company, Wilmington, N. C., has offered to sell electricity at wholesale to a co-operative group in the Tidewater section of the state at a rate that would average 1.63 cents per kilowatt-hour. The co-operative has proposed a project in Sampson, Bladen, Duplin, Pender counties.

Feeling that it cannot approve this rate as reasonable, REA is unable to allot funds for the project. A complicating factor in the situation is that the company is now asking for an additional loan of $190,000 to build lines in part of the same area. In 1935 REA made a loan of $142,000 to the utility to build lines in a number of the counties in the same general region.

•

Knoxville Appeal Dropped

Tennessee Public Service Company has dropped its appeal to the Tennessee Supreme Court from action of Chancellor A. E. Mitchell in dissolving an injunction that prevented the city of Knoxville from building a municipal power system to distribute TVA energy, according to T. G. McConnell, attorney for the utility company. No reason was given for dropping the appeal.

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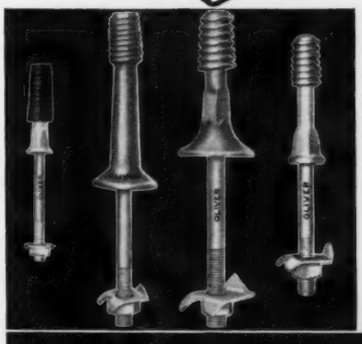

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Multiple Street Lights on Polarized Relay Control

[*Continued from page 62*]

relays will operate to turn on all the street lights. The Edison thermal relays normally keep the control circuit of the all-night relays closed. When, however, at midnight these timers are first energized (with a negative or "on" impulse) for about 45 seconds, the thermal relays open the control circuit in the all-night relays, so that when a short positive or "off" impulse immediately follows the midnight relays operate to turn off their lights, whereas the all-night light relays are inoperative and these lights stay on. At daybreak the timing relays have again cooled and closed their contacts, so that a short positive impulse operates the relays and turns off the remaining lights.

System has functioned

The system has been in operation for some time and no troubles or difficulties have been encountered. The number of lamps that can be controlled by one pilot wire depends mainly upon the capacity of the d.c. supply, each relay requiring about 60 milliamperes for operation. The voltage drop in the pilot wire is usually small, and although it must be considered, it is not a critical factor inasmuch as the relays will apparently operate satisfactorily on voltages as low as 50 to 60 volts.

That the rebuilt street-lighting system works in with the rebuilding scheme of the entire downtown distribution system and presents a neat appearance is evidenced by the accompanying picture, which shows the five-wire secondary run and a relay mounted on a pole. The system is capable of being expanded, and in addition may be completely automatized. When the capacity of the one pilot wire has been exceeded, or if it is desired for any reason to break down the pilot control and use two or more pilot circuits controlling independent sections, equipment duplicating that on the one already installed panel may be added. It will be noted from Fig. 3 that two panels of the Roanoke board are left blank. These provide for future developments and may be used by merely adding the necessary terminal blocks, reversing switch, etc., using the same rectifier and indicating instruments. The control board is also capable of being automatized by an arrangement of time-clock switches.

Sales Opportunities

TULSA, OKLA.—Public Service Company of Oklahoma, Tulsa, has plans under way for expansion and improvements in steam-electric generating plant at West Tulsa, including installation of new 20,000-kw. turbo-generator unit and auxiliary equipment, high-pressure boilers and miscellaneous apparatus. Work is scheduled to begin early in 1938. Cost estimated close to $1,000,000. Company also plans new 66-kv. transmission line from Sand Springs to Bartlesville, Okla., with power substations and switching stations at both places; a new 13-kv. power line to Foyil, Okla., with power substation and distribution facilities. Improvements and extensions will be made in electrical distribution system at Bartlesville. Last noted work, likewise, will be carried out in early next year and will represent part of line expansion for 1938, estimated to cost over $800,000.

NEWBERN, TENN.—Plans installation of an electrical distribution system, with power substation for connection with TVA transmission line, from which service will be secured. Bond issue of $33,000 has been voted for project. Work is scheduled to begin soon.

FERGUS FALLS, MINN.—Lake Region Electric Co-operative Association, Bayley Building, Fergus Falls, Noble Huse, secretary, will take bids in November for primary and secondary lines for rural electrification in parts of Becker, Ottertail, Douglas and Wilkin Counties, totaling about 320 miles, with outdoor power substations and service facilities. Cost about $325,000. This will be the first section of a 1000-mile electrification system, and bids for remainder will be asked in near future. Fund of $721,000 has been secured through federal aid, with additional financing to follow. Pillsbury Engineering Company, 1200 Second Avenue South, Minneapolis, Minn., is consulting engineer.

BUFFALO, N. Y.—Buffalo Niagara Electric Corporation has taken out a permit to build a new power substation on Best Street. Cost over $60,000 with transformers and other equipment.

LANGLEY FIELD, VA.—Purchasing and Contracting Officer, Signal Corps, Base Signal Office, Langley Field, receives bids until November 18 for five 125-foot vertical steel towers, with necessary ground net, tower warning lights, radio frequency feeders, etc., at Big Bethel Military Reservation (Proposal 1).

MERCEDES, TEX.—Magic Valley Electric Co-Operative, Inc., Mercedes, will take bids in November for primary and secondary lines for rural electrification in parts of Cameron, Hidalgo and Willacy Counties, approximating 200 miles, with outdoor power substations and service facilities. Cost about $200,000, in which amount financing has been arranged through federal aid. William G. Morrison, Professional Building, Waco, Tex., is consulting engineer.

ARLINGTON HEIGHTS, ILL. — Creamery Package Manufacturing Company, 1243 West Washington Boulevard, Chicago, plans installation of motors and controls, conveyors and other equipment in new additions to dairy machinery plant at Arlington Heights. Cost close to $200,000.

OMAHA, NEB.—Nebraska Power Company, Omaha, plans extensions in transmission and distribution lines for rural electrification in part of Dodge County, vicinity of North Bend, Neb. Application has been made for permission.

GREENVILLE, OHIO.—Darke County Rural Electric Co-Operatives, Inc., has preliminary plans under way for primary and secondary lines for rural electrification in parts of Darke County, totaling about 220 miles, with outdoor power substations and service facilities. Cost close to $200,000. Financing is being arranged through federal aid. W. R. Cutnaw, chief engineer, Ohio Farm Bureau, 246 North High Street, Columbus, Ohio, is in charge.

LOS ANGELES, CALIF.—Packard Motor Car Company, 1580 East Grand Boulevard, Detroit, Mich., plans installation of motors and controls, conveyors, transformers and accessories, electric hoists and other equipment in new branch assembling plant at South Gate, Los Angeles. Proposed to begin work early in 1938. Cost over $850,000. A power house will be built.

PEORIA, ILL. — United States Engineer Office, Postoffice Building, Chicago, Ill., receives bids until November 12 for electrical control station and equipment at Peoria Lock and Dam, Illinois River, including lock lighting system transformers and regulators, incoming power line, electric service feeders, grounding system, lock lighting system, navigation light system, portable lighting units, signal control system, fuel oil supply equipment, control station lighting system, two motor-driven oil pressure pumps, hydro-pneumatic accumulator with automatic check valve complete, high-pressure air system complete, low-pressure air system and air signal, switchboard, gasoline-electric standby power unit, two electric tow-haulage units complete, wiring system for tow-haulage units, hand-operated traveling bridge crane and complete auxiliary equipment (Circular 43).

COLUMBUS, IND. — Bartholomew County Rural Electrification Corporation, Columbus, Fred H. Suhre, president, plans primary and secondary lines for rural electrification in parts of Bartholomew and neighboring counties, totaling close to 100 miles, with power substation and service facilities. Fund of $95,000 has been secured through federal aid. Proposed to begin work soon. This is first section of a 215-mile system. Additional financing will be arranged later.

KLAMATH FALLS, ORE.—Enterprise Irrigation District, Klamath Falls, B. W. Short, president, has postponed closing of bids from October 27, recently announced, to November 10, for equipment for hydro-electric generating station on canal power site in Klamath Irrigation District, comprising a 750-hp. hydraulic turbine, with generator unit and complete auxiliary apparatus, switching equipment, etc., and transmission line from plant to Enterprise Irrigation District.

ELMIRA, N. Y.—New York State Electric & Gas Corporation, Elmira, plans extensions in primary and secondary lines for service in Elmira Heights district.

IOWA CITY, IOWA—Iowa City Light & Power Company, Iowa City, plans new transmission line from Iowa City to Coralville, with power substation and distributing facilities at latter place. Application has been made for permission.

LINCOLN, NEB.—Sealed proposal for the construction of a rural electrification distribution system to be financed by a REA loan will be received by Lancaster County Rural Public Power District November 15 at 401 Barkley Building, Lincoln. The project will be approximately 130 miles in length. Specifications may be obtained from Midwestern Engineering Company, 2408 West Second St., Hastings, Neb., owner's engineer, or from the owner.

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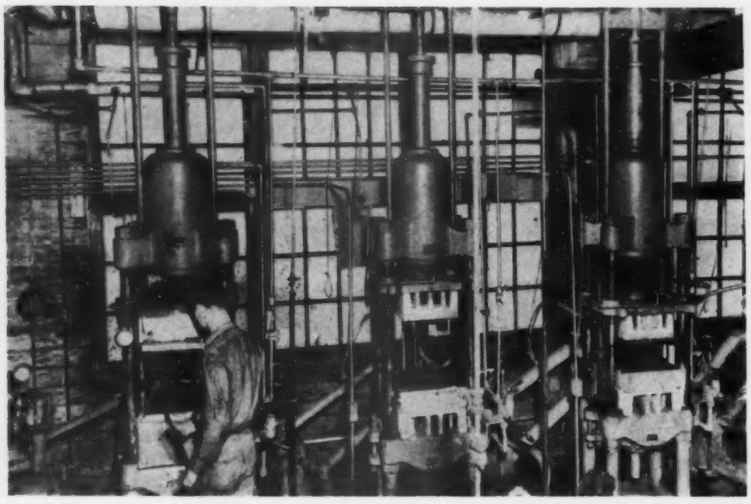

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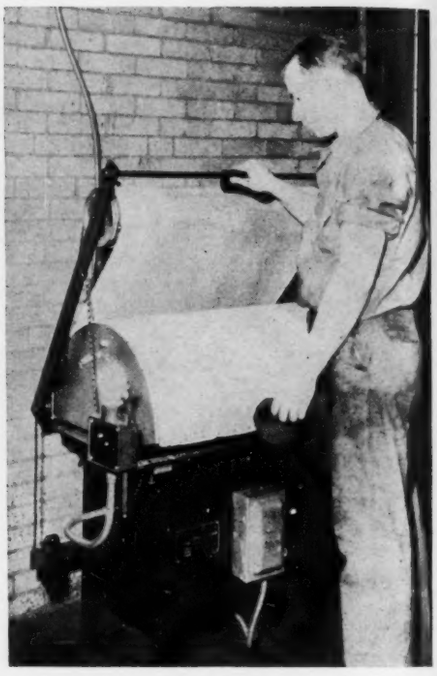

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